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BRITISH MUSEUM (NATURAL HISTORY)

CROMWELL ROAD, LONDON, S.W. 7

MINERAL DEPARTMENT

A GUIDE

TO THE COLLECTION OF

METEORITES

WITH AN ALPHABETICAL LIST OF THOSE REPRESENTED

5775

LONDON

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MINERAL DEPARTMENT

A GUIDE
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WITH AN ALPHABETICAL LIST OF THOSE REPRESENTED

BY
G. T. PRIOR, M.A., D.Sc., F.R.S.
KEEPER OF THE MINERAL DEPARTMENT OF THE BRITISH MUSEUM

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PREFACE

The guide to meteorites has been written to replace the late Sir Lazarus Fletcher's "Introduction to the Study of Meteorites," the last (eleventh) edition of which was published in 1914. Much of the subject matter of that work has been necessarily preserved, but in abbreviated form so as to reduce the cost of printing and thus enable the guide to be sold at a lower price. At the same time additional matter concerning the mineral composition, method of classification, and mutual relations of meteorites, drawn from more recent work on the subject, has been incorporated.

G. T. PRIOR.

December 24, 1925.

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ARRANGEMENT OF THE COLLECTION OF METEORITES

The collection of meteorites is contained in the Pavilion at the end of the Mineral Gallery.

The larger specimens are mounted on separate stands. These include the Cranbourne meteoric iron weighing about 3½ tons and the Otumpa meteoric iron, both of which can be seen from the entrance of the Gallery. The smaller specimens are arranged topographically in the four central cases, under the three divisions of :—

METEORIC IRONS or SIDERITES consisting chiefly of metallic nickel-iron (panes 1a–2f).

METEORIC STONY-IRONS or SIDEROLITES consisting chiefly of metallic nickel-iron and stony matter, both in large proportions (panes 2g–2l).

METEORIC STONES or AEROLITES consisting chiefly of stony matter (panes 2m–4o).

The position of any meteorite in the cases may be found by reference to the list (pp. 26–40).

The casts of meteorites are exhibited in the lower parts of the cases and on the tops of the wall-cases containing large specimens of minerals.

A series of specimens to serve as an introduction to the study of meteorites is arranged in Case 47 (panes a, b).

Plan of the Mineral Gallery

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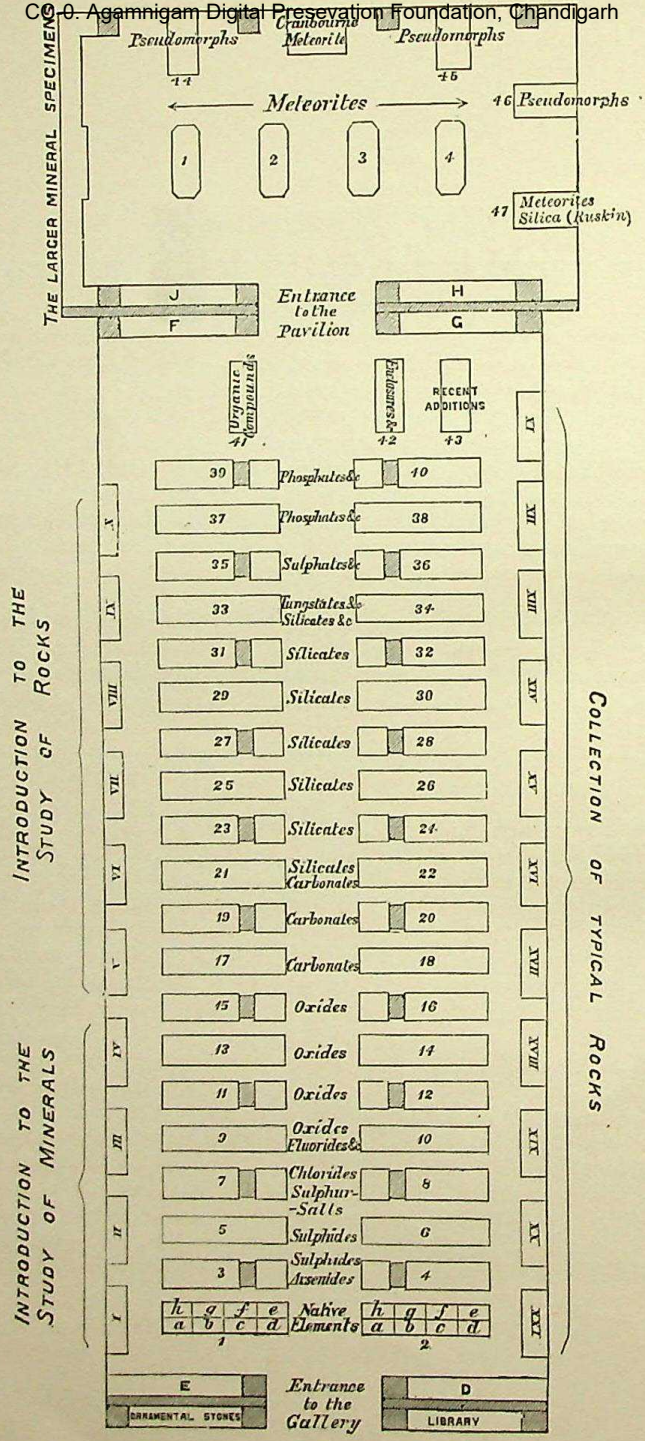

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METEORITES

Specimens of most of the meteorites referred to in the following pages are exhibited in Case 47 (panes a, b). The numbers in brackets in the text refer to the numbered specimens in that case.

HISTORY OF THE FALL OF STONES FROM THE SKY

The fall of stones from the sky has been witnessed by man from time to time throughout his history, but until the beginning of the nineteenth century reports of such events were generally received with incredulity.

One of the earliest falls to be recorded is that which, according to old Chinese manuscripts, happened in China about B.C. 644; and other ancient falls are mentioned by Plutarch and Pliny.

The stones of many of these early falls were regarded as images of the gods sent from heaven, and were made objects of worship. The Diana of the Ephesians "which fell down from Jupiter," referred to in the Acts, was perhaps a meteoric stone which was seen to fall, and so also doubtless is the sacred stone built into the corner of the Kaaba at Mecca. In Mexico masses of meteoric iron were held sacred by the Aztecs and preserved in temples. Of four stones which fell at Ogi in Japan on June 8, 1741, the two largest, one of which is now in the British Museum Collection (Case 4c), were for a long time among the offerings annually made in the temple at that place (3). Even in more recent times, meteoric stones which have fallen in India have been lost to science owing to shrines being erected over them immediately after they were found.

The earliest known meteorites still preserved are the mass of meteoric iron, which weighed 236 lb. and was believed to have fallen about 1400 at Elbogen, Bohemia, where it was known for centuries as "the bewitched Burgrave" (Case 1c), and the meteoric stone, weighing about 280 lb., which for many years was suspended by a chain in the parish church of Ensisheim in Alsace. This stone, according to a document that was preserved in the church, after a loud crash like thunder, fell about noon on Nov. 16, 1492, and was seen by a child to strike the ground where it buried itself to a depth of five feet (1).

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How little credence was afterwards given even to such authentic accounts may be judged by the fact that a stone which fell at Lucé in France on Sept. 13, 1768, nearly three centuries later, was examined by the most eminent chemists of the day, including the renowned Lavoisier, and was pronounced to be an ordinary stone which had been struck by lightning (2).

A few years later, however, the German philosopher Chladni did much towards establishing the truth of the fall of stones from the sky by collecting all the evidence for such events then available, and more particularly by calling attention to the occurrence in various parts of the world of large masses of iron the presence of which could not be accounted for except on the supposition of an extra-terrestrial origin. One of these masses, called the Pallas or Krasnojarsk iron, was found in 1749 on the top of a mountain 145 miles south of Krasnojarsk, Siberia, and was seen by the traveller Pallas in 1772 (5). This iron, like some others found later, contains numerous yellow crystals of olivine uniformly distributed through the mass (see p. 17). Another large mass weighing about 1400 lb., now in the British Museum Collection (sep. stand), was found in 1783 projecting above the ground at Otumpa in the desert of the Gran Chaco, Argentina, where no terrestrial origin for it could be imagined (4).

In later years many other masses, some of enormous size, have been found in other parts of the world. In 1818 knives of iron with bone handles, now in the British Museum Collection (6), were given by the Eskimos of West Greenland to Capt. John Ross, who was then on a voyage of discovery in Baffin's Bay. The iron of such knives and harpoons used by the Eskimos was obtained in part from three large masses of meteoric iron lying at Cape York, Melville Bay. These were seen in 1894 by the Arctic explorer, Capt. R. E. Peary, and were later transported by him to New York, where they are now preserved in the American Museum of Natural History. The one measuring about eleven feet long and known as 'Ahnighito' or 'The Tent' weighs about 36½ tons and is regarded as the largest meteorite known, although it may be rivalled by the mass of meteoric iron about 13 ft. long which is still lying where it fell on the farm El Ranchito, 7 miles south of Bacubirito in Mexico. If the original report is confirmed, these masses will sink into insignificance beside the one, said to measure 100 metres in length, which was found recently (in 1921) near Chinguetti in the desert of Adrar, Mauretania. Even this mass would be surpassed by the iron which it has been maintained must have fallen at some time near Cañon Diablo in Arizona. At that locality numerous large masses of meteoric iron (26) have been found in the neighbourhood of a curious crater-like depression known as Coon Butte, which occurs in a level plain with no signs whatever of volcanic activity, either ancient or modern, within twelve miles. This 'crater' is about 4000 ft. in diameter and 570 ft. deep, and its walls, composed of

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limestone and sandstone, rise over 100 ft. above the plain. It has been maintained that this formation owes its origin to the impact of an enormous meteorite, at least 500 ft. in diameter.

The largest meteorite preserved in the British Museum Collection is the mass of meteoric iron weighing about 3½ tons which was found in 1854 at Cranbourne, near Melbourne, Australia, and was presented to the Museum in 1862 by Mr. James Bruce (sep. stand): the largest stone in the Collection is one, weighing 133 lb., which fell at Parnallee, Madras, India, on Feb. 28, 1857 (Case 3a).

The earliest meteorite known to have fallen in the British Isles is the stone, now preserved in the British Museum Collection (Case 2p), which weighed 56 lb. and was seen to fall on Dec. 13, 1795, at Wold Cottage, near Scarborough (7).

A few years later, in 1803, there occurred at L'Aigle in France one of the most remarkable falls of stones hitherto recorded. About midday on April 26 in that year a violent explosion, followed by a rolling sound lasting for five or six minutes, was heard in the neighbourhood of L'Aigle. A few seconds before the explosion, a fire-ball moving rapidly across the sky was seen from several towns near that place; and after the explosion a shower of two to three thousand stones, the largest weighing about 20 lb., fell within an area of $6 \times 2\frac{1}{2}$ miles. The detailed report of this event by the French physicist Biot, who was sent by the French Government to investigate the phenomena, first established beyond doubt the fact of the fall to the earth of solid bodies coming from outer space (8).

The number of stones which fall at any one time and place is usually small, and may be a single one only, but occasionally, as in the L'Aigle fall, it may amount to thousands. Three of the most remarkable showers of meteoric stones are the fall of about 1000 stones at Knyahinya, Czechoslovakia, on June 9, 1866 (9, 10); of about 100,000 near Pultusk in Poland on Jan. 30, 1868 (15); and more recently of some 14,000 near Holbrook in Arizona on July 19, 1912. One of the stones of the Knyahinya fall, now in the Natural History Museum in Vienna, weighed about 645 lb. and is the largest unbroken meteoric stone known, although the largest stone known to have fallen as one individual is the one found in 1891 broken in pieces at Long Island, Kansas, for the fragments weighed together about 1200 lb. The stones of the Pultusk shower varied in weight from 20 grains to 20 lb. and were distributed over an area of about 5 square miles: the meteorite was travelling from south to north, and it is interesting to note, in this as in other falls, that the smaller stones of less momentum fell first (in the south of the area) before the larger ones in the north (16). In the Holbrook shower it was estimated that over 1000 individuals were no larger than grape seeds, but each one nevertheless was coated with the thin black crust of fused material characteristic of meteoric stones (see pp. 12–13).

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The most recent fall of a meteorite in the British Isles is that of a stone weighing about $2\frac{3}{4}$ lb. which was seen by a thatcher to fall a few yards from him in a field at Ashdon, near Saffron Walden, on March 9, 1923. In this occurrence no light or sound phenomena were observed at the place of fall except the whizzing sound of the stone as it flew through the air.

It might be expected that loss of life or injury to man would happen occasionally by the fall of meteorites, especially during showers of stones, such as that of Homestead in Iowa (see p. 11) which occurred in a fairly densely populated region, but no really authentic record of such an event is known. The narrowest escape from injury appears to have been that of three children who were sleeping in a house near Braunau in Bohemia, when one of the two masses of iron which fell there on July 14, 1847, penetrated the roof and covered them with debris.

A few other meteorites (Benares, Kilbourn, Pillistfer, etc.) have struck buildings or fallen through roofs. One of the most recent occurrences of this kind is that of one of the four stones which fell on Dec. 3, 1917, in the Strathmore district, Perthshire: this stone weighing $2\frac{1}{2}$ lb. crashed through the roof of the South Lodge of the Keithick estate.

PHENOMENA ATTENDING THE FALL OF STONES FROM THE SKY

The fall of a meteorite is generally preceded, as in that of L'Aigle, by very startling phenomena of light and sound which so far resemble a thunderstorm as to suggest the popular but misleading term applied to these bodies of 'thunderbolts.' Meteorites have no connexion with thunderstorms, and reports of the fall of 'thunderbolts' during storms really refer to lightning-strokes. Nodules of brass-yellow sulphide of iron altered on the surface to brown oxide, such as occur in the chalk on the south-east coast of England, are often mistaken for meteorites and called 'thunderbolts.'

Although we may know little as to whence they come and whither they are going, there is no doubt that meteorites before they come in contact with the earth have been travelling through space with planetary velocities of many miles a second. It is not surprising therefore that when they enter the earth's atmosphere something startling is bound to happen. Under favourable conditions for observation, as on a clear cloudless night, first of all high up in the heavens is seen a brilliant, luminous meteor or fire-ball (the meteorite rendered incandescent by friction with the air) emitting a dazzling light and moving rapidly across the sky, while it leaves behind a long, luminous trail which often persists as a white cloud for some time after the fire-ball has disappeared. The appearance of the

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fire-ball is followed first by a succession of loud crashes like thunder, and then by weird sounds which have been likened to the bellowing of oxen, the roaring of a fire in a chimney, the tearing of calico, etc. Finally, stones are seen to fall and are found buried several feet in the ground, and distributed, in the case of showers like that of L'Aigle, over areas of several square miles.

Some idea of the marvellous spectacle occasionally afforded may be gathered from the following quotation from a vivid description of the phenomena attending the fall of meteoric stones near Homestead in Iowa, U.S.A., on Feb. 12, 1875 :—" From the first the light of the meteor could hardly be tolerated by the naked eye turned full upon it. . . . Its light was not steady, but sparkled and quivered like the exaggerated twinklings of a large fixed star, with now and then a vivid flash. . . .

" Thin clouds of smoke or vapor followed in the track of the meteor and seemed to overtake it at times and then were lost. . . . The vapor would seem to burst out from the body of the meteor like puffs of steam from the funnel of a locomotive or smoke from a cannon's mouth, and then as suddenly be drawn into the space behind it. . . . The length of the train was variously estimated but was probably about 9°, or from 7 to 12 miles, as seen from Iowa City. The light about the head of the meteor at the forward part of it was a bright, deep red, with flashes of green, yellow, and other prismatic colors. The deep red blended with and shaded off into the colors of the train at the part following; but the whole head was inclosed in a pear-shaped mass of vivid white light next to the body of the meteor, and the red light fringed the white light on the edges of the figure and blended with it on the side presented to the eye. . . .

" From one and a half to two minutes after the dazzling, terrifying, and swiftly moving mass of light had extinguished itself in five sharp flashes, five quickly recurring reports were heard. The volume of sound was so great that the reverberations seemed to shake the earth to its foundations, buildings quaked and rattled, and the furniture that they contained jarred about as if shaken by an earthquake; in fact, many believed that an earthquake was in progress. Quickly succeeding, and in fact blended with the explosions, came hollow bellowings and rattling sounds, mingled with a clang and clash and roar that rolled slowly southward as if a tornado of fearful power was retreating upon the meteor's path."

Observations of the path and time of flight of the meteoritic fire-balls have given values for the relative velocities of some meteorites in the earth's atmosphere of from two to twelve miles a second, indicating in some cases absolute velocities of over twenty miles a second in space before the collision with the earth occurred. The light and sound phenomena are due to the resistance of the air to the passage of bodies moving with such enormous speed.

One result of this resistance is that in the course of not very

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many seconds the meteorite loses its planetary velocity while it is still in the upper layers of the air, and during the last part of its flight it falls under the influence of gravity alone. Thus the velocity of the stone which fell at Hvittis in Finland on Oct. 21, 1901, was calculated from the depth of the hole it made in the soil to have been only 584 ft. a second when it struck the ground, and several stones of the fall which took place at Hessle in Sweden on Jan. 1, 1869, fell upon ice only a few inches thick without breaking it.

Another result of the entry into the earth's atmosphere of a meteorite moving with planetary velocity is a sudden condensation of the air in front of it and an accumulating pressure which eventually becomes so great as to cause the mass to burst into fragments. Some of the sound phenomena may be attributed to this shattering and the subsequent flight of the fragments through the air, but the loud detonations are generally supposed to be due to the sudden explosive shock and rise in temperature given to the air by the rapid passage of the meteorite.

The light phenomena are due to the meteorite becoming incandescent and appearing as a scintillating ball of fire owing to the generation of heat through friction with the air and the consequent quick reduction in speed. As, however, the whole time during which the meteorite is in the air is only a matter of seconds, the heat does not penetrate far below the surface, and the chief result is that each of the fragments into which the main mass bursts becomes coated with a thin, black crust of fused material, usually not more than a millimetre thick. By the time they reach the ground, the stones in fact are generally only slightly warm to the touch, and in the case of the Dhurmsala and Colby falls the statement has even been made that they were so cold as to benumb the fingers.

That the individual stones of a fall have been parts of a larger mass which has burst asunder has been actually demonstrated for a few falls by some of the stones being found to fit together. This was so with the three stones which fell on Dec. 27, 1857, at Quenggouk, Lower Burma (11), and with four stones of the fall at Butsura, India, on May 12, 1861. Of these four stones which fell three or four miles apart, two found at Qutahar Bazar and Chireya respectively were completely covered with the usual fused black crust, showing that this first disruption took place when the meteorite had still a high velocity; while the two found at Piprassi and Bulloah respectively were not encrusted at the surface of fracture, indicating that the second disruption occurred when the velocity had been so much reduced that the material on the new faces had not fused (12, 13, 14). In the case of large showers of meteorites, however, the complete encrustation of most of the individual stones and their regular distribution over the area of fall have suggested the idea that they entered the earth's atmosphere as a swarm.

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COMPOSITION AND STRUCTURE OF METEORITES

Meteorites are composed of metallic iron and stony matter in varying proportions. The iron is always alloyed with nickel and a little cobalt, and the stony matter consists mainly of silicates of magnesium and iron belonging to the pyroxene and olivine groups of minerals such as occur in terrestrial basaltic igneous rocks. The proportion of cobalt to nickel on the average is roughly one-tenth.

No new element has been discovered in meteorites, but some of them contain a few minerals, such as the sulphide of calcium, oldhamite, which are unknown as terrestrial minerals since they could not exist for long in presence of oxygen and moisture.

The elements of which meteorites are mainly composed are those of low atomic weight such as occur commonly in the earth's crust, viz. aluminium, calcium, carbon, iron, magnesium, nickel, oxygen, phosphorus, silicon, and sulphur. In small amount occur chlorine, chromium, cobalt, copper, manganese, nitrogen, platinum metals, potassium, sodium, and titanium. Traces of argon, helium, and radium, and doubtfully gold, tin, and vanadium, have been recorded.

Meteoric stones have the characters of igneous and not sedimentary rocks, but, as regards average chemical composition, compared with terrestrial igneous rocks they are poorer in silica, alumina, and lime, and much richer in magnesia, ferrous oxide, and sulphur, besides containing nickeliferous iron which is of rare occurrence in the earth's crust.

The thin black crust of fused material is a striking and distinguishing feature of meteoric stones, contrasting as it usually does so markedly with the white to grey coloured interior, distributed through which can usually be seen bright specks of metallic iron. On the crust are often visible lines of flow of the molten matter which was directed from the front to the back of the stone as it flew through the air. Good examples of such lines radiating from a central spot are afforded by the stone which fell near Middlesbrough in Yorkshire on March 14, 1881 (20), and by the Ashdon stone (Case 2m).

Iron meteorites also become coated with a thin black film of fused material, in their case consisting of magnetic oxide of iron, and those which have been found soon after their fall exhibit similar lines of flow of this molten material to those shown by meteoric stones. This structure is remarkably well displayed by the iron which fell at Nedagolla in Madras on Jan. 23, 1870 (18), and by the curiously rounded and pear-shaped iron found in 1900 near Boogaldi in New South Wales (17).

Another characteristic feature of the surface of meteorites is the curious pittings, up to an inch in diameter, which have been

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likened to 'thumb-marks.' Remarkable examples of such pittings, radiating from a centre like the lines of flow of the fused material, are afforded by the stone which was found in 1868 at Goalpara, India (19), and by the Middlesbrough stone (20). The formation of these 'thumb-marks' has been attributed to the breaking off of fragments owing to the enormous pressure exerted on the surface of the rapidly moving meteorite, and partly also to the fusion and burning out of the more fusible constituents such as nodules of sulphide of iron (troilite, see p. 16). The pittings on the surface which is in front during the flight of the meteorite through the air are generally small and deep, while those on the rear face are broader and shallower.

In shape most meteorites are irregular and angular, indicating that they are only fragments of larger masses. The most common form is roughly conical, the pointed end, as shown by the lines of flow of fused material, being usually the front face. In the case of pear-shaped forms, however, such as that of Boogaldi (17), the blunt end has been the foremost face. The Tucson or 'Signet-iron,' which weighs 1514 lb., is remarkable as being ring-shaped. Jaw-shaped meteoric irons, such as Kokstad and Hex River Mountains, are supposed to be parts of original ring-shaped masses.

Meteorites may be grouped under three main divisions according to the relative amounts of nickeliferous iron and stony matter they contain. Those consisting almost wholly of nickeliferous iron are distinguished as *Meteoric Irons* or *Siderites;* those in which metal and stony matter are both in large amount, as *Meteoric Stony-irons* or *Siderolites;* and those composed mainly of stony matter, with nickeliferous iron (which is very rarely absent altogether) scattered through it in small grains, as *Meteoric Stones* or *Aerolites*.

Meteoric Irons

The metallic constituent of meteorites is not uniform in composition but consists of different alloys of iron and nickel (with cobalt), the proportions of which vary in different meteorites. The percentage of nickel therefore in the iron of meteorites (both irons and stones) varies considerably. In meteoric irons it ranges from about 4 to 30, and in the doubtful Oktibbeha County it amounts to as much as 62. In by far the greatest number it lies between about 7 and 15. Such irons are mostly characterized by a peculiar internal structure which is revealed by etching polished surfaces by the action of acids or bromine. These etch-figures, which are known as Widmanstätten figures from their discoverer, show bands of an alloy (called *kamacite*) poor in nickel (about 6 per cent.), arranged parallel to the faces of an octahedron and bordered by bright narrow seams of another alloy (called *tænite*) much richer in nickel (up to about 40 per cent.), while the interspaces are filled

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with a third material (called *plessite*) which is probably an intimate mixture of the same two alloys (23).

Irons showing such etch-figures are called *Octahedrites*, and they have been divided into groups according to the coarseness (width of the kamacite bands) of the structure. Irons, such as São Julião de Moreira (24), in which the kamacite bands are 2–5 mm. wide, are called *coarsest octahedrites*; those, such as Bischtübe (25) and Cañon Diablo (26), in which the width is from 1½ to 2 mm., *coarse octahedrites*; those, such as Juncal (23) and the iron which fell at Rowton in Shropshire on April 20, 1876 (27 and Case 1c), in which the width is from 1 to ½ mm., *medium octahedrites*, the most common type; those, such as Grand Rapids (28), in which the width is from 0·4 to 0·15, *fine octahedrites*; and those, such as Bacubirito (29), in which the width is about 0·1 mm., *finest octahedrites*. For the most part, the coarser the structure the poorer in nickel is the meteoric iron.

Meteoric irons containing less than about 7 per cent. of nickel are of two kinds. Some, such as La Primitiva (21), with percentages of nickel as low as from 4–6 show no well-defined structure on etched polished surfaces and are called *Nickel-poor ataxites*. Others, such as Hex River Mountains (22), with percentages of nickel, according to published analyses, of about the same range, but probably of rather higher average, consist almost wholly of kamacite. These show no octahedral structure on etching but, instead, a system of intercrossing fine, slightly depressed lines known as Neumann lines: as these irons generally have a rough cubic cleavage they are known as *Hexahedrites*. Meteoric irons, such as San Cristobal (30), containing higher percentages of nickel than about 16 show no definite octahedral structure and are called *Nickel-rich ataxites*.

There are some meteoric irons which are ataxites and show no octahedral structure, but yet have percentages of nickel between 7 and 15 like the octahedrites. It is supposed that in these irons the original octahedral structure has been destroyed by subsequent heating, for the effect of heat on an octahedral iron is to obliterate the structure. They have been called *Metabolites*.

Of the meteoric irons known (some 250), only about 23 have been actually seen to fall or been found immediately after a fire-ball has been seen or detonations have been heard. They are Avče, Bezerros, Boguslavka, Braunau, Cabin Creek, Charlotte, Garhi Yasin, Hassi Jekna, Hraschina, the doubtful Jefferson, Mariaville, Mazapil, Nedagolla, N'Goureyma, N'Kandhla, Okano, Pitts, Quesa, Rowton, Samelia, Treysa, Victoria West, and Winburg. The largest meteoric iron which has been seen to fall is Cabin Creek which weighed 107 lb.

All the other iron masses, like Cranbourne and Otumpa (see pp. 8–9) have been found and have been presumed to be meteoric owing to their mode of occurrence, or content of nickel, or structure.

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Native iron in the earth's crust is of very rare occurrence in some basaltic rocks. The large masses (up to 50,000 lb.) containing one or two per cent. of nickel found in 1870 by Nordenskiöld at Ovifak, Disko Island, Greenland were at first considered to be of meteoric origin, until the basalt in the neighbourhood was found to contain nickeliferous iron disseminated through it.

Minerals contained in Meteoric Irons

Meteoric irons often contain accessory minerals some of which are unknown terrestrially. Most common, perhaps, are nodules, up to 13 cm. in length, of the monosulphide of iron, *troilite*, which is closely related to, if not identical with, the terrestrial pyrrhotite (22). They are particularly plentiful in the medium octahedrites, and sometimes occur as plates orientated according to the faces of a cube. Such plates are known as Reichenbach lamellæ, and must have been formed prior to the separation of the nickel-iron alloys.

Frequently associated with troilite nodules, and often surrounding them, are inclusions of graphite and of a bright tin-white phosphide of iron and nickel called *schreibersite* (21). This phosphide is not known as a terrestrial mineral, but a similar compound is sometimes found amongst the products of iron-furnaces. Schreibersite occurs plentifully in the octahedrites, and as needle- or plate-like crystals ('*rhabdite*') more particularly in the nickel-poor irons, the hexahedrites and the nickel-poor ataxites. In the hexahedrites, the 'rhabdite' needles are sometimes orientated parallel to the Neumann lines.

In the Cañon Diablo and Magura meteoric irons, the nodules of graphite have been found to contain minute grains having the hardness of diamond (26). From the Magura and Youndegin irons have been isolated, in residues insoluble in acids, black, cubic crystals called *cliftonite* which have been regarded as pseudomorphs of graphite after diamond.

Associated with troilite in some irons, especially the nickel-poor hexahedrites and coarse octahedrites, is found occasionally a black mineral consisting of sulphide of iron combined with sulphide of chromium known as *daubreelite*. This mineral has a chemical composition similar to that of chromite, but with sulphur instead of oxygen; unlike chromite, it is completely soluble in nitric acid.

Of common occurrence in coarse octahedrites (Cañon Diablo, Magura, etc.) is the carbide of iron and nickel *cohenite* (26). It occurs usually as elongated crystals arranged parallel to the octahedral kamacite bands of the iron. Cohenite is bright tin-white like schreibersite, but differs from that mineral in being infusible and easily decomposable by a solution of copper ammonium chloride. The 'cementite' of steel is a carbide of iron similar to cohenite. A silicide

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of carbon, *moissanite*, of the same composition as the artificial carborundum, has been isolated from the Cañon Diablo iron.

A common constituent, especially of nickel-rich irons, is the chloride of iron, *lawrencite*. This mineral usually manifests its presence on polished surfaces as liquid drops which rapidly become brown from production of ferric hydroxide by oxidation. As this change is accompanied by increase in volume, irons containing lawrencite (*e.g.* Cranbourne) are apt to rust readily and fall to pieces unless they are protected from oxidation and moisture by a coating of shellac and by being kept dry.

Chromite, as nodules generally associated with troilite, is of frequent occurrence in meteoric irons. In the insoluble residue of many irons, minute splinters having the characters of quartz have been found in small amount. If these splinters are really of pre-terrestrial origin, it is remarkable, since meteorites, with one exception (Steinbach, see below), are distinguished by an absence of free silica.

Included gases in meteoric irons consist mainly of hydrogen, carbon dioxide, carbon monoxide, nitrogen, and marsh-gas. In some irons the presence of helium and argon has been recorded.

Some meteoric irons (*e.g.* Copiapo) contain small inclusions of ferromagnesian silicates, and thus approach the intermediate group between irons and stones of stony-irons or siderolites.

Meteoric Stony-irons or Siderolites

In these meteorites, of which about 30 are known, the iron and stony matter are in about equal amounts. In some of them, such as Brenham (31), the stony matter consists only of the mineral olivine. These are known as *Pallasites* from the earliest known of them, the 'Pallas iron,' to which reference has already been made (see p. 8). In pallasites, the olivine occurs, sometimes as rounded crystals and sometimes as angular fragments, enmeshed in the nickel-iron which on etching shows octahedral structure. The olivines are usually surrounded by a band of kamacite indicating that the metal solidified subsequently to the silicate.

In other stony-irons, the stony matter consists of pyroxene (mostly hypersthene) with a little olivine, and anorthite-felspar generally as broken fragments. In these stony-irons, such as Morristown (32), which are known as *Mesosiderites*, the metal occurs as more detached pieces and does not enmesh the stony portion in the same way as it does in the pallasites.

Of exceptional composition are the stony-irons of which only one representative of each is known, viz. the Lodran meteorite, in which the stony matter consists of olivine and bronzite, and the Steinbach meteorite (including Breitenbach and Rittersgrün), in which it is composed of bronzite and tridymite (asmanite) (33).

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The latter stony-iron, which is called a *Siderophyre*, is remarkable as being the only known meteorite containing an appreciable amount of free silica.

Meteoric Stones

Unlike the irons, most of the known (some 600) meteoric stones have actually been seen to fall; for if not found at the time of their fall, they are much less easily recognized and are more liable to decomposition and disintegration, through oxidation of the small grains of nickel-iron distributed through them, than large masses of iron. The fall of meteoric stones appears therefore to be of much more frequent occurrence than that of irons.

The stony matter of most meteoric stones, as already indicated (p. 13), consists mainly of pyroxene and olivine, with only a little interstitial felspar which is mostly oligoclase. In composition, therefore, most meteoric stones approximate to the ultra-basic terrestrial igneous rocks known as peridotites and picrites; and like them they contain chromite in small amount as an almost invariable constituent. The characteristic features which distinguish most of them from terrestrial rocks are the presence of scattered grains of nickeliferous iron and troilite (the same sulphide of iron that is found in the meteoric irons), and of curious rounded bodies called *chondrules*. By far the largest number of meteoric stones (about 90 per cent.) contain these chondrules and are called *chondrites*.

The gases included in meteoric stones consist, as in the irons, mainly of hydrogen, carbon dioxide, carbon monoxide, nitrogen, and marsh-gas. Of these gases, carbon dioxide is most abundant, whereas in the irons hydrogen and carbon monoxide predominate.

Many meteoric stones, especially chondrites, *e.g.* Bluff, Orvinio, and Girgenti (37), are traversed by black thread-like veins composed of fused material of the same chemical composition as the rest of the stone. These veins are probably due to penetration of heat into pre-terrestrial fissures during the flight of the meteorite through the earth's atmosphere.

Some stones have the characters of breccias, since they consist of irregular fragments cemented together.

Chondrites

Chondritic meteoric stones are made up of chondrules (more or less plentiful) embedded in a tufaceous to crystalline groundmass consisting of irregular grains of pyroxene and olivine, with scattered particles of nickel-iron and troilite fairly uniformly distributed through it. A little colourless interstitial material is generally present and may consist of oligoclase-felspar, maskelynite (like felspar

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in chemical composition but singly instead of doubly refractive), or merrillite (a phosphate of lime and soda).

The pyroxenes differ from those of terrestrial basaltic rocks in their low content of lime and alumina. They are mainly orthorhombic in crystallization and in different meteorites may be enstatite, bronzite, or hypersthene according to the increasing proportion of ferrous oxide to magnesia in their composition, so that chondritic stones can be grouped under the three divisions of enstatite-, bronzite-, and hypersthene-chondrites. Monoclinic kinds of pyroxene are also generally present, and as they are likewise poor in lime and alumina, are best described as clinoenstatite, clinobronzite, and clinohypersthene.

In both pyroxenes and olivines the amount of ferrous oxide associated with magnesia varies considerably in different meteorites. The percentage of nickel in the nickel-iron also shows similar wide variations to that in the meteoric irons. Recent analyses indicate that the proportion of nickel in the nickel-iron and that of ferrous oxide in the ferromagnesian silicates in meteorites are not independent variables, but are so related that in general *the richer in nickel is the nickel-iron the richer in ferrous oxide are the magnesian silicates*, and in most chondrites the poorer in nickel-iron is the meteorite.

There appears therefore to be a consanguinity between meteoric stones suggestive of their derivation by progressive oxidation from a common magma. The original magma might be represented by the least oxidized chondrites, the *enstatite-chondrites*, such as Hvittis, Daniel's Kuil, and Khairpur (34), in which chondrules are rare, the stony matter consists almost solely of a silicate of magnesia, enstatite, practically free from ferrous oxide, and the iron (in large amount) is poor in nickel (about 7 per cent.). In these stones, iron is hardly in the oxidized condition at all, and even calcium and chromium are only partially so, since they are partly present in the form of sulphides; for these particular chondrites, and no others, contain appreciable amounts of daubreelite, the sulphur equivalent of chromite (see p. 16), and the sulphide of calcium, oldhamite (see p. 13), which is unknown as a terrestrial mineral though it is found occasionally in furnace slags.

The next division, the *bronzite-chondrites*, such as Cronstad (36), appear to have been formed under higher conditions of oxidation, for ferrous oxide enters into the composition of both pyroxene and olivine, and the nickel-iron is in smaller amount and correspondingly richer in nickel, since little or no nickel appears to be oxidized so long as any iron still remains in the metallic state. Recent analyses seem to show that little or no oxide of nickel enters into the composition of the pyroxene and olivine of meteorites.

In the next division, the *hypersthene-chondrites* such as Baroti and Girgenti (37), still more ferrous oxide enters into the composition of the ferromagnesian silicates and the nickel-iron is in still smaller amount and richer still in nickel.

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A classification of meteorites based upon the proportion of iron to nickel in the nickel-iron, and correspondingly also of the magnesia to ferrous oxide in the magnesian silicates, is shown on the opposite page.

Chondrites have been grouped, apart from their chemical composition, according to colour, as white [such as Girgenti (37)], intermediate (between white and grey) [such as Alfianello (38)], grey [such as Appley Bridge (39)], and black [such as Farmington (40)];—according to structure, as brecciated [such as Supuhee], veined [such as Girgenti (37)], spherical [such as Ausson (41)] when the chondrules are well-formed and easily break away from the matrix, and crystalline [such as Khairpur (34)] when the groundmass is more crystalline than tufaceous;—and as carbonaceous [such as Cold Bokkeveld (42)] when they are impregnated with carbonaceous matter.

The chondrules which constitute such a remarkable and interesting feature of these meteorites are mostly of about the size of millet seeds, but occasionally as large as walnuts. In spherical chondrites they are mostly well-formed and spherical, loosely attached to the matrix, and occasionally fragmental; but in others (*e.g.* white chondrites) they are often of ill-defined contour and pass insensibly into the matrix, in which they are so firmly embedded as to break with it.

Chondrules are formed of the same minerals, pyroxene and olivine, with oligoclase-felspar and glass, as the rest of the stone. Some consist mainly of olivine (35), either as well-formed crystals porphyritic in a glassy base, or as parallel bars alternating with bars of felspar or glass. Others are of pyroxene, sometimes in fibrous form with fibres frequently radiating from the edge and not from the centre (35). In these characters chondrules differ essentially from the spherulites of terrestrial rocks.

The presence of glassy material is mainly confined to the chondrules, which thus show more signs of hasty crystallization than the matrix. Chondrules are often surrounded by a zone of nickel-iron, occasionally one is enclosed in another, and more rarely two are grown together having apparently interfered with each other's growth. The rounded form of these bodies, therefore, does not appear to be due to attrition or wearing down by frequent collision such as might happen, as was once suggested, by repeated ejection from a volcanic vent, but rather to consolidation from a molten state under exceptional conditions. The eccentricity of the crystallization and the porphyritic character of some of them lend support to the theory of Sorby that they were originally molten drops like fiery rain which consolidated in an atmosphere heated to nearly their own temperature.

The carbonaceous chondrites, such as Alais, Cold Bokkeveld (42), and Orgueil, present an interesting problem. They are black and pulverulent and contain small amounts of hydrocarbons and

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Tabular Classification of Meteorites.

Group →		1	2	3	4
← Class.	Nickel-iron →	Fe : Ni = 13 and over.	Fe : Ni = 13 — 8.	Fe : Ni = 8 — 2.	—
	Magnesian silicates →	Enstatite (and Clino-enstatite).	Bronzite (and Clino-bronzite) and Olivine.	Hypersthene (and Clino-hypersthene) and Olivine.	Pyroxene (mostly monoclinic) and Olivine.
	Felspar →	MgO : FeO very high to ∞. Oligoclase.	MgO : FeO over 4. Oligoclase.	MgO : FeO = 4 — 2. Oligoclase.	MgO : FeO less than 2. Anorthite.
Irons. 1	Siderites → Mainly nickel-iron.	Nickel-poor Ataxites. Hexahedrites. Coarsest Octahedrites. Coarse Octahedrites.	Medium Octahedrites to Finest Octahedrites.	Some Finest Octahedrites (?). Nickel-rich Ataxites.	Oktibbeha County (?).
Stony-Irons. 2	Siderolites* → Nickel-iron in large amount.		Most Pallasites. Siderophyre. Lodranite. Mesosiderites.†	A few Pallasites.	
Stones (Aerolites). 3	Chondrites → Nickel-iron generally in decreasing amount from left to right.	*Enstatite-chondrites.* Daniel's Kuil (Hvittis) type.	*Bronzite-olivine-chondrites.* Cronstad type.	*Hypersthene-olivine-chondrites.* Baroti and Soko-Banja types.	
Stones (Aerolites). 4	Achondrites → (Non-chondritic stones). Nickel-iron in small amount or absent.	*Enstatite-achondrites.* Aubrites. (Aubres, Bishopville, and Bustee).	*Clinobronzite-olivine-achondrites.* Ureilites.	*Hypersthene-olivine-achondrites.* [dites). Amphoterites (and Ro-*Hypersthene-achondrites.* Diogenites (Shalka, etc.). *Olivine-achondrites.* Chassignite.	*Calcium-rich Achondrites.* Angrite, Nakhlite. Eucrites, Sherghottite, Howardites. Mesosiderites.†

* As defined by N. S. Maskelyne, including both the lithosiderites and siderolites of Brezina.
† Mesosiderites as regards iron and olivine belong to Group 2, as regards pyroxene and felspar to Group 4.

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oxygenated hydrocarbons allied to bitumen and petroleum, the presence of which in a sedimentary terrestrial rock would be referred to plant or animal origin. Such a reference in the case of these meteorites of igneous character is hardly possible, nor is it conceivable that these organic compounds could have been formed during the brief passage of the meteorite through the earth's atmosphere. Their origin is doubtless pre-terrestrial. As they can be removed by solution in alcohol and ether without previous pulverization of the stone and thus appear to be contained only in the pores, the late Prof. N. S. Maskelyne suggested that they may have been absorbed by the meteorite from an atmosphere containing these substances in a state of vapour.

Some black chondritic stones, such as Tadjera and McKinney, appear to have been heated throughout since their consolidation, for the effect of heat upon other stones is to turn them black and reproduce generally the character of these black chondrites.

Achondrites

The small group of stones which show no chondrules are more crystalline and less tufaceous than the chondrites, and moreover, contain little or no nickel-iron.

They can be divided into two groups, one poor in lime and corresponding in chemical and mineral composition to the chondrites except that they contain little nickel-iron; and the other rich in lime, and in some members also in alumina, and thus widely separated from other meteoric stones.

Of the first group, corresponding to enstatite-chondrites are the enstatite-achondrites or *Aubrites*, consisting almost wholly of enstatite free from oxide of iron. An interesting member of this group, of which only three or four are known, is Bustee (43) as it contains nodules made up mainly of an almost iron-free diopside and chestnut-brown oldhamite, the same sulphide of calcium which is present in the enstatite-chondrites. Corresponding to bronzite-chondrites are the *Ureilites* (Novo-Urei, Goalpara (44), and Dyalpur), which are made up of clinobronzite and olivine enmeshed in a fine network consisting of nickel-iron and graphitic material enclosing small grains having the hardness of diamond. Corresponding to hypersthene-chondrites are the *Amphoterites*, consisting of hypersthene and olivine, of which only about five are known; the hypersthene-achondrites or *Diogenites*, consisting mainly of hypersthene, of which there are three known, viz. Shalka (45), Manegaon, and Ibbenbühren; and *Chassignite*, consisting of olivine alone, of which there is only one representative known.

The calcium-rich group appear to have been formed under conditions of higher oxidation and approach terrestrial rocks much

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more closely than other meteorites. *Angrite* and *Nakhlite*, of which only one representative of each is known, consist largely of a calcium- and iron-rich diopside and thus resemble pyroxenites; while the *Eucrites*, such as Stannern (46) and Juvinas, and the *Howardites*, consisting mainly of anorthite-felspar and a calc-clinohypersthene near to hedenbergite, are like terrestrial dolerites and often show a similar ophitic structure.

The Sherghotty meteorite (47) is in chemical composition and structure like a eucrite, but contains isotropic maskelynite instead of anorthite.

ORIGIN OF METEORITES

The prevailing idea with regard to the origin of meteorites dates from the time of Chladni, who in 1794 gave reasons for believing that the detonating meteoritic fire-ball and the ordinary meteor or shooting-star are only varieties of one phenomenon. Shooting-stars were supposed to be meteorites so small that on their entry into the earth's atmosphere they become incandescent and are completely burnt up and dissipated in the upper layers of the air, leaving nothing to fall to the ground.

When it was discovered that the orbits of some comets were identical with those of certain remarkable showers of shooting-stars, it was inferred that comets are really swarms of meteorites most of which, but not all, are of minute size. The fact that during showers of shooting-stars all gradations are observed between ordinary meteors and those approaching in size and brilliancy the meteoritic fire-ball, appears to lend support to this theory as to the origin of meteorites.

To the theory, however, there are some objections, for although meteorites, meteors, and comets thus appear to be closely related, they need not be absolutely identical. In the first place, with the solitary exception of the Mazapil meteoric iron, meteorites are not known to fall during displays of shooting-stars, and in the second place they do not fall most frequently at the time of year during which star-showers are prevalent. By far the largest number of meteorites have fallen in May and June, whereas the period of greatest number of shooting-stars is from July to November. It is conceivable, therefore, that, although ordinary shooting-stars may be minute solid bodies such as constitute comets, those larger masses which we know as meteorites may have no direct connexion with comets and have some other origin. The general similarity of meteorites in chemical composition, the almost invariable presence in them of nickeliferous iron and troilite, and more especially the evidence they afford of consanguinity or derivation by progressive oxidation from a common type (see p. 19) certainly suggest that they belonged originally to a single body. Such a body, it has been imagined, might have been a planet or planetoid which had suffered a

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catastrophic disruption. If so, this shattering must have been of a deep-seated character, affecting its already solid interior. One result of such a process might be the production of that fiery rain of molten drops of Sorby (see p. 20), which are now represented by the chondrules of chondritic meteoric stones, while the more crystalline, non-chondritic stones as well as the large masses of iron might be parts of the original mass which had suffered less alteration. Opposed to such a planetary origin of meteorites, and also to their absolute identity with comets, is the idea that, although some, like the comets, appear to belong to the solar system, others seem to have come from such directions and with such velocities as to suggest an interstellar origin. Such an assumption, however, owing to the close similarity in chemical composition of meteorites, would imply an extraordinary uniformity in composition of the 'earth-material' of the universe. Moreover, the evidence for a hyper-planetary velocity in space of some meteorites, on which it is based, appears to have been afforded more by observations on meteors than on meteorites. If the objections to a planetary origin of meteorites could be removed, there might then be some reason for the revival of the old idea, which at one time was advocated, that the planet which has given rise to meteorites is the earth itself, which, according to this theory, is now gradually picking up again material flung from her at an early stage of her existence.

From this point of view, any light which the study of meteorites may throw upon the constitution of the earth's interior gains increased significance. The fact that meteorites contain several minerals, such as the sulphide of calcium, oldhamite, and the phosphide of iron and nickel, schreibersite, which are unknown as terrestrial minerals, since they could not exist for long in the presence of oxygen and moisture, indicates that meteorites have been formed under conditions of lower oxidation than obtain on the earth's surface. Beneath its well-oxidized crust, however, there are reasons (amongst others, because its density as a whole is nearly double that of the crust) for supposing that the earth in its interior is composed of material much less rich in oxygen. The general opinion at the present day is that the actual core consists of nickeliferous iron like that of meteorites. Above this core, it has been suggested, between 3000 km. and 1600 km. below the surface, within which limits earthquake velocity is nearly constant, is a zone composed of silicates mixed with nickel-iron which gradually decreases in amount upwards. The base of such a zone might very well be formed of material like that of the Daniel's Kuil type of meteoric stone in which nickel-iron in large amount and poor in nickel is mixed with magnesium silicate free from oxide of iron, while the upper part would correspond to the more oxidized Baroti type of meteoric stone in which the ferromagnesian silicates are increasingly rich in ferrous oxide and the nickel-iron is in decreasing amount and correspondingly richer in nickel. Nearer the earth's surface this

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zone might be succeeded first by a eucrite-like zone in which iron is no longer present in the metallic state, but only as ferrous oxide in the silicates, and then by one of the composition of basalt in which some of the iron has passed to the ferric condition (in magnetite). Above the basalt, according to some theories of the composition of the earth's crust, comes the sharply contrasted granitic zone which may possibly have originated by the rise to the surface of the more volatile constituents, such as chlorides and fluorides of silicon and metals (more particularly the alkalies and aluminium), water, etc.; and the old idea has been gaining ground recently that all the other igneous rocks of the earth's crust have resulted from interaction between these two basaltic and granitic magmas, combined occasionally with some assimilation of sedimentary material.

No meteorites which have been seen to fall approach in chemical composition that of the terrestrial granitic zone. Those mysterious bodies known as *Tektites* (Case 47b), however, have the glassy structure and approximate chemical composition of rhyolite-obsidian, the glassy equivalent of granite. They are small rounded bodies, usually not more than an inch across, and are found in Bohemia, Australia, and the East Indies, not in obvious connexion with recent volcanoes or with ancient volcanic rocks. Those found in Bohemia to which the name *Moldavite* has been given are of irregular shape, fairly transparent, of olive-green colour, and curiously pitted on the surface as if by corrosion. The Australian ones, known as *Australites*, and those from the East Indies, known as *Billitonites*, are of darker colour and often assume button-like and dumb-bell-like forms, showing sometimes flow structure, suggestive of their having solidified from a molten condition during flight and rotation. Owing to the difficulty of accounting for their occurrence terrestrially, a meteoric origin has been attributed to these bodies by some scientists; but, as they differ so widely in chemical composition and structure from all other known meteorites, the idea cannot be accepted without reservation until some have actually been seen to fall.

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LIST OF THE METEORITES

REPRESENTED IN THE BRITISH MUSEUM COLLECTION

ON JANUARY 1, 1926

The symbols used in the second column to indicate the kind of meteorite, are mainly those of A. Brezina. They are as follows :—

Irons...
- O = octahedrite, with attached *gg* meaning coarsest, *g* coarse, *m* medium, *f* fine, *ff* finest, *b* brecciated.
- H = hexahedrite, with attached *b* meaning brecciated.
- D = ataxite, with attached *a* meaning nickel-poor, and *r* nickel-rich.

Stony-irons...
- P = pallasite, with attached *b* meaning brecciated.
- M = mesosiderite.
- Lo = lodranite.
- S = siderophyre.

Stones...
- C = chondrite, with attached *a* meaning veined, *b* brecciated, *c* spherical, *e* enstatite, *g* grey, *i* intermediate, *k* crystalline, *s* black, *w* white, *y* hypersthene, *z* bronzite.
- K = carbonaceous chondrite, with attached *c* meaning spherical.
- Au = aubrite or enstatite-achondrite.
- U = ureilite.
- Am = amphoterite, with attached *b* meaning brecciated (= rodite).
- Di = diogenite.
- Cha = chassignite.
- An = angrite.
- N = nakhlite.
- Eu = eucrite.
- Sh = sherghottite.
- Ho = howardite, with attached *b* meaning brecciated.

The date given in the third column is that of fall, except where 'found' or 'known' is added.

The weight given in the fourth column is in grams (1000 grams = 2·205 lb.) or in kilograms when 'kg.' is added. Weights less than a gram are indicated by a dash.

The numbers in the fifth column indicate the case containing the meteorite, and the letters the pane behind which it will be found.

A list of some synonyms is given on pp. 41–42.

Name.	Kind.	Date.	Weight.	Pane.
Adargas, Mexico . . .	Om	Known for centuries.	47	2d
Admire, Kansas . . .	Pb	Found 1881.	1,076	2k
Agen, France . . .	Cia	Sept. 5, 1814.	40	2o
Ahumada, Mexico . .	P	Found 1909.	653	2k
Ainsworth, Nebraska .	Ogg	Found 1907.	536	1m
Akbarpur, India . . .	Cgb	April 18, 1838.	1,569	3m
Alais, France . . .	K	March 15, 1806.	13	2o
Albareto, Italy . . .	Ccy	July, 1766.	52	3d
Aldsworth, England . .	Cga	Aug. 4, 1835.	520	2m
Aleppo, Syria	Cwb	About 1873 (?).	77	3l

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Name.	Kind.	Date.	Weight.	Pane.
Alessandria, Italy	Cga	Feb. 2, 1860.	172	3d
Alfianello, Italy	Ciy	Feb. 16, 1883.	2,731	3d, 47b
Algoma, Wisconsin	Om	Found 1887.	17	2c
Allegan, Michigan	Ccz	July 10, 1899.	992	4l
Ambapur Nagla, India	Cck	May 27, 1895.	1,075	3n
Andover, Maine	Cc	Aug. 5, 1898.	20	4l
Angers, France	Cwa	June 3, 1822.	22	2n
Angra dos Reis, Brazil	An	Jan. 30, 1869.	6	4o
Annaheim, Canada	Og	Found 1916.	360	1g
Anthony, Kansas	Cg	Found 1919.	234	4l
Apoala, Mexico	Of	Found 1889.	283	2e
Appley Bridge, England	Cgy	Oct. 13, 1914.	11,325	2m, 47b
Apt, France	Cga	Oct. 8, 1803.	37	2o
Arispe, Mexico	Ogg	Found 1896.	1,910	2d
Arlington, Minnesota	Om	Found 1894.	157	1m
Asco, Corsica	Cwa	Nov., 1805.	—	2o
Ashdon, England	Cwy	March 9, 1923.	1,243	2m
Asheville, N. Carolina	Om	Found 1839.	116	1n
Assam, India	Cgb	Known 1846.	539	4c
Assisi, Italy	Cc	May 24, 1886.	156	3d
Atarra, India	Cs	Dec. 23, 1920.	75	4c
Aubres, France	Au	Sept. 14, 1836.	498	2n
Auburn, Alabama	H	Found 1867.	37	1h
Augustinovka, Ukraine	Of	Found 1890.	950	1d
Aumale, Algeria	Cwa	Aug. 25, 1865.	82	4e
Aumières, France	Cwa	June 3, 1842.	43	2o
Ausson, France	Cc	Dec. 9, 1858.	586	2o, 47b
Babb's Mill, Tennessee	Dr	Found 1842.	2,127	1o
Bachmut, Ukraine	Cwy	Feb. 15, 1814.	40	3l
Bacubirito, Mexico	Off	Found 1863.	1,146	2d, 47a
Ballinoo, W. Australia	Off	Found 1892.	3,555	1e
Bandong, Java	Amb	Dec. 10, 1871.	57	4d
Barbotan, France	Cga	July 24, 1790.	790	2o
Baroti, Punjab	Cwy	Sept. 15, 1910.	936	3m
Barraba, New South Wales	Da	Found.	107	1e
Barranca Blanca, Chile	Ob	Found 1855.	11,910	2f
Barratta, New South Wales	Cs	Found 1845.	2,769	4d
Bath, South Dakota	Ccb	Aug. 29, 1892.	2,119	4n
Bath Furnace, Kentucky	Ci	Nov. 15, 1902.	1,013	4m
Bear Creek, Colorado	Of	Found 1866.	52	1k
Beaver Creek, British Columbia	Cckz	May 26, 1893.	721	4f
Bella Roca, Mexico	Of	Known 1888.	3,537	2d
Benares, India	Cc	Dec. 19, 1798.	510	3n
Bendegó, Brazil	Og	Found 1784.	3,639	2e
Berlanguillas, Spain	Cia	July 8, 1811.	26	3c
Bethany, South Africa	Of	Known 1836.	19,222	1b, 1f
Bethlehem, New York	Cck	Aug. 11, 1859.	—	4m
Beuste, France	Cgb	May, 1859.	40	2o
Bhagur, Bombay	Cwa	Nov. 27, 1877.	6	3o
Bherai, Bombay	Cway	April 28, 1893.	17	3o
Bholghati, India	Ho	Oct. 29, 1905.	28	4c
Bialystok, Poland	Ho	Oct. 5, 1827.	4	3g
Bielokrynitschie, Ukraine	Cca	Jan. 1, 1887.	60	3g

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Name.	Kind.	Date.	Weight.	Pane.
Billings, Missouri . . .	Og	Found 1903.	633	1m
Bingera, New South Wales	Da	Found 1880.	255	1e
Bischtübe, Siberia . .	Og	Found 1888.	1,970	1d, 47a.
Bishopville, S. Carolina .	Au	March 25, 1843.	509	4m
Bishunpur, India . . .	Cs	April 26, 1895.	392	3n
Bitburg, Rhenish Prussia.	P	Known 1805.	1,550	2g
Bjelaja Zerkov, Ukraine .	Cc	Jan. 15, 1796.	9	3l
Bjurböle, Finland . . .	Ccy	March 12, 1899.	153	3e
Black Mountain, N. Carolina	Og	Found about 1839.	71	1m
Blansko, Moravia . . .	Cgaz	Nov. 25, 1833.	—	3e
Blithfield, Canada. . .	Cek	Found 1910.	114	4f
Bluff, Texas	Ckby	Found about 1878.	12,539	4a
Bocas, Mexico . . .	Cw	Nov. 24, 1804.	35	4n
Bohumilitz, Bohemia .	Og	Found 1829.	179	1e
Boogaldi, New South Wales	Of	Found 1900.	179	1d
Borgo San Donnino, Italy.	Cg	April 19, 1808.	9	3d
Bori, India	Cia	May 9, 1894.	1,270	3n
Borkut, Ruthenia . .	Cc	Oct. 13, 1852.	40	3f
Borodino, Russia . . .	Cgb	Sept. 5, 1812.	1	3k
Brahin, Russia . . .	P	Found 1810.	22	2h
Braunau, Bohemia . .	H	July 14, 1847	554	1e
Bremervörde, Hanover .	Ccbz	May 13, 1855.	828	3e
Brenham, Kansas . .	P	Found 1882.	2,008	2h, 47b
Bridgewater, N. Carolina .	Of	Found 1890.	51	1n
Bur-Gheluai, Italian Somaliland	Cg	Oct. 16, 1919.	2,172	4d
Burlington, New York .	Om	Found before 1819.	312	1m
Buschhof, Latvia . . .	Cway	June 2, 1863.	162	3g
Bustee, India	Au	Dec. 2, 1852.	1,429	3m, 47b
Butler, Missouri . . .	Off	Found before 1874.	389	1m
Butsura, India . . .	Ci	May 12, 1861.	19,080	3n, 3o, 47a
Cabeza de Mayo, Spain .	Cw	Aug. 18, 1870.	64	3e
Cabin Creek, Arkansas .	Om	March 27, 1886.	5	1h
Cacaria, Mexico . . .	Om	Found 1867.	310	2d
Cachiyuyal, Chile . . .	Om	Found 1874.	28	2f
Cambria, New York . .	Of	Found 1818.	5,329	1m
Canellas, Spain . . .	Ci	May 14, 1861.	1	3e
Cangas de Onis, Spain .	Cgb	Dec. 6, 1866.	301	3e
Cañon Diablo, Arizona .	Og	Found 1891.	83,497	1h, 1l, sep. stand, 47a
Canton, Georgia . . .	Om	Found 1894.	330	1k
Canyon City, California .	Om	Found 1875.	193	1h
Cape Girardeau, Missouri.	Ccz	Aug. 14, 1846.	78	4m
Cape of Good Hope, South Africa	Dr	Found 1793.	328	1f
Caperr, Patagonia . .	Om	Known 1869.	313	2f
Cape York, West Greenland	Om	Known 1818.		1g, 47a
Caratash, Asia Minor . .	Am	Aug. 22, 1902.	8	3l
Carcote, Chile	Ckz	Known 1888.	2	4o

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Name.	Kind.	Date.	Weight.	Pane.
Carlton, Texas . . .	Of	Found 1887.	6,180	1o
Carthage, Tennessee . .	Om	Found 1840.	24,610	1o
Casas Grandes, Mexico .	Om	Known 1867.	989	2d
Casey County, Kentucky .	Og	Known 1877.	45	1l
Castalia, N. Carolina . .	Cgbz	May 14, 1874.	29	4m
Castine, Maine . . .	Cway	May 20, 1848.	2	4l
Cedar, Texas	Cca	Found 1900.	221	4n
Central Missouri . . .	Ogg	Found about 1855.	988	1l
Cereseto, Italy . . .	Ccb	July 17, 1840.	124	3d
Chail, India	Cwb	Nov. 5, 1814.	—	3n
Chainpur, India . . .	Cc	May 9, 1907.	399	3n
Chandakapur, India . .	Ciby	June 6, 1838.	746	3n
Chandpur, India . . .	Cwa	April 6, 1885.	490	3n
Chantonnay, France . .	Cgby	Aug. 5, 1812.	1,400	2n
Charcas, Mexico . . .	Om	Known 1804.	333	2d
Charlotte, Tennessee . .	Of	Aug. 1, 1835.	77	1o
Charsonville, France . .	Cga	Nov. 23, 1810.	1,499	2n
Charwallas, Punjab . .	Ci	June 12, 1834.	37	3m
Chassigny, France. . .	Cha	Oct. 3, 1815.	40	2o
Château-Renard, France .	Ciay	June 12, 1841.	3,386	2n
Chervettaz, Switzerland .	Cck	Nov. 30, 1901.	29	3d
Chesterville, S. Carolina .	Da	Found before 1849.	2,197	1n
Chilkoot, Alaska . . .	Om	Known 1881.	39	1h
Chinautla, Guatemala .	Om	Found 1902.	1,441	2e
Chulafinnee, Alabama .	Om	Found 1873.	60	1h
Chupaderos, Mexico . .	Of	Known for centuries.	1,087	2d
Cleveland, Tennessee . .	Om	Found 1860.	209	1o
Coahuila, Mexico . . .	H	Known 1837.	251,242	2c, 2d, sep. stand.
Cobija, Chile	Ck	Found 1892.	763	4o
Colby, Wisconsin . . .	Cia	July 4, 1917.	1,589	4n
Cold Bay, Alaska . . .	P	Found 1921.	33	2h
Cold Bokkeveld, South Africa	K	Oct. 13, 1838.	1,127	4e, 47b
Colfax, North Carolina .	Om	Found 1880.	52	1n
Collescipoli, Italy . . .	Ccz	Feb. 3, 1890.	485	3d
Cookeville, Tennessee .	Og	Found about 1913.	135	1o
Coon Butte, Arizona .	Cgb	Found 1905.	178	1h
Coopertown, Tennessee .	Om	Known 1860.	179	1o
Copiapo, Chile	Ob	Found 1863.	766	2f
Cosby's Creek, Tennessee.	Og	Known before 1837.	50,530	1n
Cosina, Mexico . . .	Ck	Jan. 11, 1844.	42	4n
Costilla Peak, New Mexico	Om	Found 1881.	1,595	1m
Cowra, New South Wales	Off	Found 1888.	221	1d
Crab Orchard, Tennessee .	M	Found 1887.	1,151	2h
Cranbourne, Victoria . .	Og	Found 1854.	3,507 kg.	1d, sep. stand.
Cranganore, India. . .	Cwa	July 3, 1917.	256	4c
Cronstad, South Africa .	Cgaz	Nov. 19, 1877.	1,169	4f, 47b
Cross Roads, North Carolina	Cg	May 24, 1892.	11	4m
Crumlin, Ireland . . .	Cgy	Sept. 13, 1902.	3,860	2m
Cuernavaca, Mexico . .	Of	Found 1889.	1,024	2d

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Name.	Kind.	Date.	Weight.	Pane.
Cullison, Kansas	Ccz	Found 1911.	2,789	4m
Cumberland Falls, Kentucky	Au+Ce	April 9, 1919.	638	4l
Cynthiana, Kentucky	Cgy	Jan. 23, 1877.	140	4l
Dalton, Georgia	Om	Found 1877.	277	1k
Dandapur, India	Ciay	Sept. 5, 1878.	2,585	3m
Daniel's Kuil, South Africa	Cek	March 20, 1868.	459	4f
Danville, Alabama	Cgay	Nov. 27, 1868.	27	4f
Darmstadt, Hesse	Cga	Before 1804.	1	3c
Davis Mountains, Texas	Om	Found 1903.	41	2c
Deal, New Jersey	Ci	Aug. 15, 1829.	—	4m
Deep Springs, North Carolina	Dr	Found 1846.	170	1n
Dehesa, Chile	Off	Found before 1868.	2	2f
Delegate, New South Wales	Om	Found 1904.	186	1e
Denton County, Texas	Om	Known 1856.	122	1o
Descubridora, Mexico	Om	Found bet. 1780–83.	4,473	2d
Dhurmsala, Punjab	Ciy	July 14, 1860.	12,399	3l
Djati-Pengilon, Java	Ckz	March 19, 1884.	469	4d
Dokachi, Bengal	Cc	Oct. 22, 1903.	622	4c
Dolgovoli, Poland	Cw	June 26, 1864.	3	3k
Donga Kohrod, India	Ci	Sept. 23, 1899.	39	3o
Doroninsk, Siberia	Cgb	April 6, 1805.	9	3l
Drake Creek, Tennessee	Cway	May 9, 1827.	18	4n
Duel Hill (1854), North Carolina	Of	Found 1854.	130	1n
Duel Hill (1873), North Carolina	Og	Found 1873.	12	
Dundrum, Ireland	Ckz	Aug. 12, 1865.	245	2m
Dungannon, Virginia	Om	Known 1923.	75	2c
Durala, Punjab	Ciay	Feb. 18, 1815.	12,095	3b
Duruma, East Africa	Cia	March 6, 1853.	—	4c
Dyalpur, India	U	May 8, 1872.	269	3n
Eagle Station, Kentucky	P	Found 1880.	701	2l
Eichstädt, Bavaria	Ccz	Feb. 19, 1785.	47	3d
Elbogen, Bohemia	Om	Fell 1400 (?).	111	1c
El Capitan, New Mexico	Om	Found 1893.	956	1m
Eli Elwah, New South Wales	Cwy	Found 1888.	13,871	4d
Elm Creek, Kansas	Ccy	Found 1906.	912	4k
Emmitsburg, Maryland	Om	Found 1854.	6	1l
Ensisheim, France	Cky	Nov. 16, 1492.	451	2n, 47a
Epinal, France	Cc	Sept. 13, 1822.	1	2o
Ergheo, Italian Somaliland	Cky	July, 1889.	1,032	4d
Erxleben, Prussia	Ckz	April 15, 1812.	31	3c
Esnandes, France	Cg	Aug., 1837.	2	2o
Estacado, Texas	Ckz	Found 1883.	17,103	4a
Estherville, Iowa	M	May 10, 1879.	116,824	2a, 2k
Farmington, Kansas	Csy	June 25, 1890.	797	4l, 47b
Favars, France	Ci	Oct. 21, 1844.	6	2o
Felix, Alabama	Key	May 15, 1900.	37	4f
Finmarken, Arctic Norway	P	Found 1902.	1,306	2g
Fisher, Minnesota	Ciay	April 9, 1894.	598	4l

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Name.	Kind.	Date.	Weight.	Pane.
Forest City, Iowa	Ccbz	May 2, 1890.	2,556	4h
Forsbach, Rhenish Prussia	Ci	June 12, 1900.	9	3d
Forsyth, Georgia	Cway	May 8, 1829.	72	4h
Forsyth County, North Carolina	Da	Found about 1891.	538	1k
Fort Pierre, South Dakota	Om	Found 1856.	2,016	1n
Four Corners, New Mexico	Ob	Found about 1923.	1,179	2h
Franceville, Colorado	Om	Found 1890.	772	1h
Frankfort (stone), Alabama	Ho	Dec. 5, 1868.	32	4f
Frankfort (iron), Kentucky	Om	Found 1866.	216	1l
Fukutomi, Japan	Cga	March 19, 1882.	230	4c
Futtehpur, India	Cwa	Nov. 30, 1822.	1,422	3n
Gambat, Bombay	Cia	Sept. 15, 1897.	1,752	3n
Garhi Yasin, Bombay	Om	Jan. 1917.	380	1d
Gilgoin, New South Wales	Ckz	Found 1889.	2,236	4d
Girgenti, Sicily	Cway	Feb. 10, 1853.	366	3d, 47b
Glorieta Mountain, New Mexico	Om	Found 1884.	2,590	1m
Gnadenfrei, Silesia	Ccz	May 17, 1879.	40	3d
Goalpara, Assam	U	Found 1868.	1,184	4c, 47b
Gopalpur, Bengal	Ccz	May 23, 1865.	147	4c
Grand Rapids, Michigan	Of	Found 1883.	1,468	1l, 47a
Greenbrier County, West Virginia	Og	Found 1880.	2,332	2c
Groslée, France	iron	Found 1827.	50	1c
Grosnaja, Caucasus	Cs	June 28, 1861.	167	3l
Gross-Divina, Czechoslovakia	Cc	July 24, 1837.	3	3e
Grossliebenthal, Ukraine	Cway	Nov. 19, 1881.	141	3l
Grüneberg, Silesia	Cga	March 22, 1841.	30	3d
Guareña, Spain	Ck	July 20, 1892.	69	3c
Guilford County, North Carolina	Om	Known before 1822.	18	1n
Gumoschnik, Bulgaria	Cg	April 26, 1904.	5	3f
Gurram Konda, Madras	Cw	1814.	8	3o
Gütersloh, Westphalia	Ccb	April 17, 1851.	109	3c
Hainholz, Westphalia	M	Found 1856.	500	2h
Hammond, Wisconsin	Om	Found 1884.	62	2c
Harrison County, Indiana.	Ccy	March 28, 1859.	35	4k
Hayden Creek, Idaho	Om	Found 1895.	79	1l
Hedjaz, Arabia	Cgz	Spring, 1910.	102	3l
Hendersonville, North Carolina	Ccy	Found 1901.	123	4m
Heredia, Costa Rica	Ccb	April 1, 1857.	53	4n
Hermitage Plains, New South Wales	Cg	Found 1909.	667	4d
Hessle, Sweden	Ccz	Jan. 1, 1869.	905	2m
Hex River Mountains, South Africa	H	Found 1882.	530	1f, 47a
Higashi-kōen, Japan	Cg	Aug. 11, 1897.	29	4c
High Possil, Scotland.	Cw	April 5, 1804.	91	2m
Holbrook, Arizona	Ccky	July 19, 1912.	7,804	4g, 4h
Holland's Store, Georgia	Hb	Found 1887.	194	1k

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Name.	Kind.	Date.	Weight.	Pane.
Homestead, Iowa	Cgbz	Feb. 12, 1875.	3,927	4k
Honolulu, Hawaiian Islands	Cway	Sept. 27, 1825.	86	4d
Hraschina, Croatia	Om	May 26, 1751.	282	1c
Huizopa, Mexico	Of	Found 1907.	1,495	2d
Hungen, Hesse	Cga	May 17, 1877.	5	3c
Hvittis, Finland	Cek	Oct. 21, 1901.	153	3f
Ibbenbühren, Westphalia	Di	June 17, 1870.	3	3c
Ilimaes (pallasite), Chile	P	Found 1874–5.	266	2l
Ilimaes (iron), Chile	Om	Known 1870.	39	2f
Illinois Gulch, Montana	Dr	Found 1899.	637	1m
Imilac, Chile	P	Known 1822.	212,563	sep. stand, 2l
Indarch, Transcaucasia	Kc	April 7, 1891.	486	3l
Indian Valley, Virginia	Hb	Found 1887.	82	2c
Indio Rico, Argentina	Ck	Found 1887.	1	4o
Iron Creek, Canada	Om	Known before 1869.	79	1g
Itapicuru-Mirim, Brazil	Cc	March, 1879.	6	4o
Ivanpah, California	Om	Found 1880.	33	1h
Jackalsfontein, South Africa	Ci	April 22, 1903.	65	4e
Jackson County, Tennessee	Om	Known 1846.	91	1o
Jamestown, North Dakota	Of	Found 1885.	1,627	1n
Jamkheir, Bombay	Ccb	Oct. 5, 1866.	15	3o
Jelica, Serbia	Am	Dec. 1, 1889.	1,878	3c
Jemlapur, India (?)	Ci	Feb., 1901.	468	4c
Jenny's Creek, West Virginia	Og	Found 1883.	78	2c
Jerome, Kansas	Cckz	Found 1894.	6	4l
Jhung, Punjab	Cc	June 3, 1873.	1,839	3m
Jodzie, Lithuania	Hob	June 17, 1877.	1	3f
Joel's Iron, Chile	Om	Found 1858.	1,206	2f
Joe Wright Mountain, Arkansas	Om	Found 1884.	372	1h
Jonzac, France	Eu	June 13, 1819.	9	2o
Judesegeri, Mysore	Cc	Feb. 16, 1876.	130	3o
Juncal, Chile	Om	Found 1866.	72	2f, 47a
Juvinas, France	Eu	June 15, 1821.	964	2o
Kaba, Hungary	K	April 15, 1857.	104	3f
Kadonah, India	Cga	Aug. 7, 1822.	39	3n
Kaee, India	Cc	Jan. 29, 1838.	209	3n
Kakangari, Madras	Cc	June 4, 1890.	122	3o
Kakowa, Rumania	Cgay	May 19, 1858.	150	3f
Kalumbi, Bombay	Cwa	Nov. 4, 1879.	29	3o
Kangra Valley, Punjab	Cc	About 1897.	395	3m
Karakol, Siberia	Cw	May 9, 1840.	24	3l
Karee Kloof, South Africa	Og	Found about 1914.	457	1f
Karkh, Baluchistan	Cg	April 27, 1905.	226	3m
Kendall County, Texas	Hb	Known 1887.	556	1o
Kenton County, Kentucky	Om	Found 1889.	2,520	1l
Kerilis, France	Cga	Nov. 26, 1874.	74	2n
Kermichel, France	Ck	Found 1911.	112	2n
Kernouvé, France	Ckaz	May 22, 1869.	9,375	2n
Kesen, Japan	Ccy	June 12, 1850.	1,280	4c

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Name.	Kind.	Date.	Weight.	Pane.
Khairpur, Punjab . .	Cek	Sept. 23, 1873.	3,431	3m, 47b
Kharkov, Ukraine . .	Cwa	Oct. 12, 1787.	437	3l
Kheragur, India . . .	Cc	March 28, 1860.	353	3n
Khetri, Rajputana . .	Cgbz	Jan. 19, 1867.	13	3m
Khohar, India . . .	Cg	Sept. 19, 1910.	338	3n
Kikino, Russia . . .	Cg	1809.	28	3f
Kilbourn, Wisconsin . .	Cg	June 16, 1911.	1	4n
Killeter, Ireland . . .	Cwa	April 29, 1844.	101	2m
Kingston, New Mexico .	Om	Found 1891.	360	1m
Klein-Wenden, Germany.	Ck	Sept. 16, 1843.	5	3c
Klondike, Canada . .	Dr	Found 1901.	362	1g
Knyahinya, Czechoslovakia	Cgy	June 9, 1866.	11,384	3d, 3e, 47a
Kodaikanal, Madras . .	Ob	Found 1898.	2,548	1d
Kokomo, Indiana . .	Dr	Found 1862.	45	1l
Kokstad, South Africa .	Om	Found 1884.	203	1f
Kota-Kota, British Central Africa	Cc	Known before 1905.	333	4e
Kouga Mountains, South Africa	Om	Known before 1916.	297	1g
Krähenberg, Rhenish Bavaria	Ciy	May 5, 1869.	10	3c
Krasnoi-Ugol, Russia .	Cc	Sept. 9, 1829.	5	3k
Krasnojarsk, Siberia . .	P	Found 1749.	3,413	2g, 47a
Kuleschovka, Ukraine .	Cwa	March 12, 1811.	58	3l
Kusiali, India	Cw	June 16, 1860.	4	3n
Kuttippuram, Madras. .	Cwa	April 6, 1914.	750	3n, 3o
Kyushu, Japan . . .	Cwa	Oct. 26, 1886.	31,354	4b, 4c
La Bécasse, France . .	Cw	Jan. 31, 1879.	19	2n
Laborel, France . . .	Ci	June 14, 1871.	291	2n
La Caille, France . . .	Om	Known 1828.	379	1c
La Grange, Kentucky .	Of	Found 1860.	216	1l
L'Aigle, France . . .	Ciby	April 26, 1803.	2,201	2n, 47a
Lakangaon, Central India	Eu	Nov. 24, 1910.	93	3o
Lake Brown, West Australia	Ci	Found 1919.	174	4d
Lalitpur, India . . .	Cia	April 7, 1887.	79	3n
Lancé, France . . .	Kc	July 23, 1872.	870	2n
Lançon, France . . .	Cia	June 20, 1897.	200	2o
La Primitiva, Chile . .	Da	Found 1888.	9,766	2f, 47a
Launton, England . .	Ciay	Feb. 15, 1830.	201	2m
Laurens County, South Carolina	Of	Found 1857.	61	1n
Leeuwfontein, Transvaal .	Ciy	June 21, 1912.	135	4e
Leighton, Alabama . .	Cgb	Jan. 12, 1907.	91	4f
Lenarto, Czechoslovakia .	Om	Found 1814.	2,018	1d
Les Ormes, France . .	Cw	Oct. 1, 1857.	12	2n
Lesves, Belgium . . .	Cg	April 13, 1896.	56	2n
Le Teilleul, France . .	Ho	July 14, 1845.	2	2n
Lexington County, South Carolina	Og	Found 1880.	271	1n
Lick Creek, North Carolina	H	Found 1879.	19	1n
Lime Creek, Alabama .	Dr	Found 1834.	19	1h
Limerick, Ireland . . .	Cgaz	Sept. 10, 1813.	150	2m

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Name.	Kind.	Date.	Weight.	Pane.
Linum, Germany	Cw	Sept. 5, 1854.	2	3o
Linville, North Carolina	Dr	Found 1882.	21	1n
Lissa, Bohemia	Cwa	Sept. 3, 1808.	172	3e
Little Piney, Missouri	Cc	Feb. 13, 1839.	104	4m
Lixna, Latvia	Cgaz	July 12, 1820.	135	3f
Locust Grove, Georgia	Da	Found 1857.	571	1k
Lodran, Punjab	Lo	Oct. 1, 1868.	56	2h
Lonaconing, Maryland	Og	Found 1888.	74	1l
Long Island, Kansas	Ciay	Found 1891.	1,285	4l
Losttown, Georgia	Om	Found 1868.	6	1k
Lucé, France	Cwa	Sept. 13, 1768.	5	2n, 47a
Lucky Hill, Jamaica	Om	Found 1885.	4,640	2e
Luis Lopez, New Mexico	Om	Found 1896.	425	1m
Lumpkin, Georgia	Ccky	Oct. 6, 1869.	17	4h
Lundsgard, Sweden	Cwy	April 3, 1889.	195	2m
Luotolax, Finland	Ho	Dec. 13, 1813.	20	3f
Luponnas, France	Cib	Sept. 7, 1753.	7	2o
Lutschaunig's Stone, Chile	Cg	Found 1861.	92	4o
Macao, Brazil	Cia	Nov. 11, 1836.	6	4o
Madoc, Canada	Of	Found 1854.	205	1g
Madrid, Spain	Cway	Feb. 10, 1896.	18	3c
Magura, Czechoslovakia	Og	Found 1840.	9,110	1c
Mainz, Hesse	Ciay	Found 1852.	33	3c
Makariwa, New Zealand	Cgby	Found 1879.	62	4d
Manbhoom, Bengal	Am	Dec. 22, 1863.	123	4c
Manegaon, Bombay	Di	June 29, 1843.	11	3o
Mantos Blancos, Chile	Of	Found 1876.	9,027	2e
Marion, Iowa	Cway	Feb. 25, 1847.	950	4h
Marjalahti, Finland	P	June 1, 1902.	3,093	2k
Marmande, France	Cc	July 4, 1848.	4	2o
Marshall County, Kentucky	Om	Described 1860.	80	1l
Mart, Texas	Off	Found 1898.	430	2c
Mascombes, France	Cw	Jan. 31, 1835.	5	2o
Mässing, Bavaria	Ho	Dec. 13, 1803.	—	3c
Matatiela, South Africa	Om	Known 1878.	40	1f
Mauerkirchen, Upper Austria	Cwy	Nov. 20, 1768.	305	3e
Mazapil, Mexico	Om	Nov. 27, 1885.	14	2d
McKinney, Texas	Csy	Found 1870.	1,289	4n
Menow, Germany	Cck	Oct. 7, 1862.	1,132	3c
Merceditas, Chile	Om	Found 1884.	1,917	2f
Mern, Denmark	Ccka	Aug. 29, 1878.	119	2m
Merua, India	Cgz	Aug. 30, 1920.	4,308	4c
Meuselbach, Thuringia	Cckay	May 19, 1897.	19	3c
Mezö-Madaras, Transylvania	Cgby	Sept. 4, 1852.	766	3e
Mhow, India	Ci	Feb. 16, 1827.	163	3n
Middlesbrough, England	Cwy	March 14, 1881.	22	2m
Mighei, Ukraine	K	June 18, 1889.	246	3l
Milena, Croatia	Cw	April 26, 1842.	150	3e
Minas Geraes, Brazil	Cwa	Known 1888.	65	4n
Mincy, Arkansas	M	Found 1857.	2,451	2h
Mirzapur, India	Ciba	Jan. 7, 1910.	208	3n
Misshof, Latvia	Ccz	April 10, 1890.	202	3f

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Name.	Kind.	Date.	Weight.	Pane.
Misteca, Mexico . . .	Om	Known 1804.	316	2d
Mocs, Transylvania . .	Cway	Feb. 3, 1882.	14,677	3e
Moctezuma, Mexico . .	Om	Found 1899.	170	2d
Modoc, Kansas . . .	Cway	Sept. 2, 1905.	2,045	4l
Mokoia, New Zealand .	K	Nov. 26, 1908.	175	4d
Molina, Spain	Cgbz	Dec. 24, 1858.	401	3c
Molong, New South Wales	P	Found 1912.	2,022	2h
Monroe, North Carolina .	Cgaz	Oct. 31, 1849.	385	4m
Monte Milone, Italy . .	Cwb	May 8, 1846.	8	3d
Montlivault, France . .	Cw	July 22, 1838.	11	2n
Moonbi, New South Wales	Of	Found 1892.	409	1e
Mooranoppin, Western Australia	Ogg	Found about 1893.	261	1e
Mooresfort, Ireland . .	Cga	Aug., 1810.	257	2m
Moradabad, India . .	Cw	Fell 1808.	17	3n
Mornans, France . . .	Cga	Sept., 1875.	1,019	2o
Morradal, Norway . .	Dr	Found 1892.	92	1d
Morristown, Tennessee .	M	Found 1887.	557	2k, 47b
Moti-ka-nagla, Rajputana	Ck	Dec. 22, 1868.	417	3m
Mount Ayliff, South Africa	Og	Known 1907.	290	1g
Mount Browne, New South Wales	Ccz	July 17, 1902.	201	4d
Mount Dyrring, New South Wales	P	Found 1903.	235	2h
Mount Edith, Western Australia	Om	Found 1913.	1,193	1e
Mount Joy, Pennsylvania.	Ogg	Found 1887.	730	1n
Mount Stirling, Western Australia	Og	Known 1892.	1,888	1e
Mount Vernon, Kentucky	P	Known about 1868.	1,250	2k
Muddoor, Mysore . . .	Ccy	Sept. 21, 1865.	410	3n
Mungindi, New South Wales	Off	Found 1897.	368	1d
Muonionalusta, Sweden .	Of	Found 1906.	142	1c
Murfreesboro, Tennessee .	Om	Found 1847.	2,790	1o
Murphy, North Carolina .	H	Found 1899.	1,521	1n
Nagaria, India . . .	Eu	April 24, 1875.	13	3m
Nagy-Borové, Czechoslovakia	Cg	May 9, 1895.	53	3e
Nagy-Vázsony, Hungary .	Om	Found 1890.	107	1c
Nakhla, Egypt . . .	N	June 28, 1911.	1,988	4d
Nammianthal, Madras .	Cca	Jan. 27, 1886.	1,626	3o
Nanjemoy, Maryland . .	Cc	Feb. 10, 1825.	325	4l
Narraburra, New South Wales	Off	Found 1855.	1,918	1d
Nawapali, India . . .	K	June 6, 1890.	21	3o
Nedagolla, Madras . .	Da	Jan. 23, 1870.	4,280	1d
Nejed, Central Arabia .	Om	Found 1863.	58,672	1b
Nelson County, Kentucky	Ogg	Found 1856.	4,341	1l
Nenntmannsdorf, Saxony	H	Found 1872.	15	1c
Nerft, Latvia	Ciay	April 12, 1864.	166	3f
Ness County, Kansas . .	Ck	Found 1894.	2,631	4m
Netschaëvo, Russia . .	Ob	Found 1846.	1,075	1c
New Baltimore, Pennsylvania	Ogg	Found 1922.	553	1n

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Name.	Kind.	Date.	Weight.	Pane.
New Concord, Ohio . .	Ciay	May 1, 1860.	19,713	4m
Ngawi, Java	Ccy	Oct. 3, 1883.	51	4d
N'Goureyma, French West Africa	Ob	June 15, 1900.	871	1e
Niagara, Dakota . . .	Og	Found 1879.	17	1n
N'Kandhla, South Africa.	Om	Aug. 1, 1912.	17,150	1e
Nobleborough, Maine . .	Ho	Aug. 7, 1823.	—	4l
Nochtuisk, Siberia . .	Og	Found 1876.	4	1d
Nocoleche, New South Wales	Om	Known 1895.	687	1d
Nogoya, Argentina. . .	K	June 30, 1879.	31	4o
Novo-Urei, Russia . .	U	Sept. 4, 1886.	22	3k
Nulles, Spain	Cgbz	Nov. 5, 1851.	27	3c
Oakley, Kansas . . .	Ckz	Found 1895.	2,495	4l
Obernkirchen, Hesse-Nassau	Of	Known before 1863.	35,050	1p
Ochansk, Russia . . .	Ccbz	Aug. 30, 1887.	5,262	3l
Oczeretna, Ukraine . .	Cga	Found 1871.	109	3l
Oesel, Esthonia . . .	Cwy	May 11, 1855.	29	3f
Ogi, Japan	Cwz	June 8, 1741.	4,341	4c, 47a
Ohaba, Transylvania . .	Cgaz	Oct. 11, 1857.	39	3f
Okano, Japan	H	April 7, 1904.	313	1d
Okniny, Poland . . .	Cgb	Jan. 8, 1834.	7	3k
Oktibbeha County, Mississippi	Dr	Found about 1854.	—	1l
Olivenza, Spain . . .	Cg	June 19, 1924.	1,295	3d
Orange River (iron), South Africa	Om	Known 1855.	95	1f
Orgueil, France . . .	K	May 14, 1864.	618	2o
Ornans, France . . .	Cc	July 11, 1868.	1,025	2n
Oroville, California . .	Om	Found 1893.	373	1h
Orvinio, Italy	Csz	Aug. 31, 1872.	93	3d
Oscuro Mountains, New Mexico	Og	Found 1895.	494	1m
Ottawa, Kansas . . .	Cg	April 9, 1896.	154	4k
Otumpa, Argentina . .	Da	Found 1783.	634,724	Sep. stand, 2f, 47a
Owens Valley, California .	Om	Found 1913.	277	1h
Pacula, Mexico . . .	Cwb	June 18, 1881.	28	4n
Pampanga, Philippine Islands	Cgb	April 4, 1859.	8	4d
Pan de Azucar, Chile . .	Og	Found 1887.	19,508	2b, 2f
Parnallee, Madras . .	Cgay	Feb. 28, 1857.	60,992	3a, 3o
Pavlodar, Siberia . . .	P	Found 1885.	68	2h
Pavlograd, Ukraine . .	Cw	May 19, 1826.	162	3l
Pavlovka, Russia . . .	Ho	Aug. 2, 1882.	74	3k
Perth, Scotland . . .	Ci	May 17, 1830.	1	2m
Petersburg, Tennessee .	Ho	Aug. 5, 1855.	48	4n
Petropavlovsk, Siberia .	Om	Found 1841.	12	1d
Pillistfer, Latvia . . .	Cek	Aug. 8, 1863.	344	3f
Pipe Creek, Texas . .	Ckaz	Found 1887.	909	4n
Pirgunje, Bengal . . .	Cwa	Aug. 29, 1882.	748	3o
Pirthalla, Punjab . . .	Ccb	Feb. 9, 1884.	427	3m
Pittsburg, Pennsylvania .	Ogg	Found about 1850.	208	1n

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Name.	Kind.	Date.	Weight.	Pane.
Plainview, Texas . . .	Cia	Found 1917.	2,828	4n
Ploschkovitz, Bohemia .	Ccb	June 22, 1723.	25	3e
Plymouth, Indiana . .	Om	Found 1893.	445	1l
Pohlitz, Germany . .	Cwa	Oct. 13, 1819.	87	3c
Pokhra, India	Ckz	May 27, 1866.	46	3m
Ponca Creek, Nebraska .	Ogg	Found 1863.	224	1o
Pooposo, Bolivia . . .	Og	Known 1910.	26	2e
Prairie Dog Creek, Kansas	Cck	Found 1893.	529	4l
Prambanan, Java . .	Of	Known 1797.	8	1d
Pricetown, Ohio . . .	Cw	Feb. 13, 1893.	10	4m
Pulsora, Central India .	Cib	March 16, 1863.	48	3n
Pultusk, Poland . . .	Cgaz	Jan. 30, 1868.	18,184	3g, 3h, 3k, 47a
Puquios, Chile . . .	Om	Found 1885.	176	2f
Putnam County, Georgia .	Of	Found 1839.	112	1k
Queens Mercy, South Africa	Cg	April 30, 1925.	49	4e
Quenggouk, Lower Burma	Cc	Dec. 27, 1857.	718	4c
Quinçay, France . . .	Cgb	Fell Summer, 1851.	10	2n
Rafrüti, Switzerland . .	D	Found 1886.	1	1c
Rakovka, Russia . . .	Ciy	Nov. 20, 1878.	372	3k
Ranchapar, India . .	Csa	Feb. 20, 1917.	78	4c
Rancho de la Pila, Mexico.	Om	Found 1882.	45,584	1a
Ratteldraai, South Africa .	Og	Found 1909.	226	1f
Red River, Texas . . .	Om	Found 1808.	507	1o
Reed City, Michigan . .	Og	Found 1895.	876	1m
Renazzo, Italy . . .	Cs	Jan. 15, 1824.	15	3d
Rhine Villa, South Australia	Om	Found 1900.	193	1d
Richardton, North Dakota	Ccaz	June 30, 1918.	1,429	4m
Richmond, Virginia . .	Ccky	June 4, 1828.	169	4n
Rochester, Indiana . .	Cc	Dec. 21, 1876.	9	4k
Roda, Spain	Amb	Spring, 1871.	7	3c
Rodeo, Mexico . . .	Of	Found 1852.	409	2d
Roebourne, Western Australia	Om	Found 1892.	1,616	1c
Rosario, Honduras . .	Og	Found 1896.	117	2c
Rowton, England . . .	Om	April 20, 1876.	3,221	1c, 47a
Ruff's Mountain, South Carolina	Om	Found 1844.	572	1o
Russel Gulch, Colorado .	Of	Found 1863.	293	1h
Sacramento Mountains, New Mexico . . .	Om	Found 1896.	14,050	1m
St. Caprais-de-Quinsac, France	Ci	Jan. 28, 1883.	9	2o
St. Denis-Westrem, Belgium	Ccay	June 7, 1855.	1	2n
St. Francois County, Missouri	Og	Known before 1863.	106	1m
St. Genevieve County, Missouri	Of	Found 1888.	6,445	1p
St. Germain-en-Puel, France	Cc	July 4, 1890.	169	2n
St. Mark's, South Africa .	Cc	Jan. 3, 1903.	102	4e
St. Mesmin, France . .	Ciby	May 30, 1866.	110	2n

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Name.	Kind.	Date.	Weight.	Pane.
St. Michel, Finland	Cwy	July 12, 1910.	958	3f
Saline, Kansas	Ccky	Found 1901.	385	4k
Salles, France	Cia	March 12, 1798.	165	2n
Salt Lake City, Utah	Cgbz	Found 1869.	4	4n
Salt River, Kentucky	Off	Found about 1850.	524	1l
Sams Valley, Oregon	Om	Found 1894.	64	1n
San Angelo, Texas	Om	Found 1897.	771	1o
San Cristobal, Chile	Dr	Found about 1882.	145	2f, 47a
San Emigdio, California	Cc	Known 1887.	33	4h
San Francisco del Mezquital, Mexico	Da	Known before 1868.	7,138	2d
Santa Barbara, Brazil	Cg	Sept. 26, 1873.	1	4o
Santa Catharina, Brazil	Dr	Found 1875.	6,395	2e
Santa Rosa, Colombia	Ob	Found 1810.	1,159	2e
São Julião de Moreira, Portugal	Ogg	Known before 1883.	892	1c, 47a
Sarepta, Russia	Og	Found 1854.	283	1d
Sauguis, France	Cwa	Sept. 7, 1868.	16	2o
Savtschenskoje, Ukraine	Cck	July 27, 1894.	62	3l
Schellin, Prussia	Cia	April 11, 1715.	—	3c
Schönenberg, Bavaria	Cway	Dec. 25, 1846.	42	3d
Schwetz, Poland	Om	Found 1850.	1,062	1c
Scott City, Kansas	Cc	Found 1905.	130	4l
Scottsville, Kentucky	H	Found 1867.	404	1k
Searsmont, Maine	Ccz	May 21, 1871.	51	4l
Seeläsgen, Prussia	Ogg	Known before 1847.	9,880	1c
Segowlie, India	Ck	March 6, 1853.	1,205	3o
Sena, Spain	Cgb	Nov. 17, 1773.	—	3c
Seneca Falls, New York	Om	Found 1850.	54	1m
Seres, Macedonia	Cg	June 1818.	399	3f
Serrania de Varas, Chile	Of	Found 1875.	1,476	2f
Sevrukovo, Russia	Csz	May 11, 1874.	20	3k
Shalka, India	Di	Nov. 30, 1850.	1,323	3o, 47b
Shelburne, Canada	Cga	Aug. 13, 1904.	1,791	4f
Sherghotty, India	Sh	Aug. 25, 1865.	117	4c, 47b
Shingle Springs, California	Dr	Found 1869–70.	84	1h
Shrewsbury, Pennsylvania	Om	Found 1907.	938	1n
Shupiyan, Kashmir	Cgb	April, 1912.	69	3m
Shytal, Bengal	Ciby	Aug. 11, 1863.	449	3o
Siena, Italy	Ci	June 16, 1794.	127	3d
Sierra Blanca, Mexico	Og	Found 1784.	15	2d
Silver Crown, Wyoming	Og	Found 1887.	583	2c
Simmern, Rhenish Prussia	Cw	July 1, 1920.	7	3c
Simondium, South Africa.	Ho	Found 1907.	1,026	4e
Sinai, Egypt	Ci	July 14–17, 1916.	116	4e
Sindhri, Bombay	Cc	June 10, 1901.	1,247	3o
Siratik, West Africa	Da	Found 1716.	395	1e
Sitathali, India	Cgz	March 4, 1875.	653	3n
Ski, Norway	Cway	Dec. 27, 1848.	4	2m
Slavetic, Croatia	Cgb	May 22, 1868.	20	3e
Slobodka, Russia	Cc	Aug. 10, 1818.	27	3g
Smithland, Kentucky	Dr	Found 1839–40.	2,545	1l
Smith's Mountain, North Carolina	Of	Found about 1863.	77	1n
Smithville, Tennessee	Og	Found 1840.	1,719	1o

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Name.	Kind.	Date.	Weight.	Pane.
Soko-Banja, Serbia	Ccy	Oct. 13, 1877.	1,965	3f
South Bend, Indiana	P	Found 1893.	181	2k
Ssyromolotovo, Siberia	Om	Found 1873.	3	1d
Ställdalen, Sweden	Cgbz	June 28, 1876.	1,638	2m
Stannern, Moravia	Eu	May 22, 1808.	1,708	3e, 47b
Staunton, Virginia	Om	Found 1858–9.	2,893	2c
Stavropol, Russia	Ckz	March 24, 1857.	23	3l
Steinbach, Saxony	S	Found 1724.	7,731	2g, 47b
Strathmore, Scotland	Ciy	Dec. 3, 1917.	1,056	2m
Sultanpur, India	Cs	July 10, 1916.	270	4c
Summit, Alabama	H	Known since 1890.	47	1h
Supuhee, India	Cgb	Jan. 19, 1865.	4,268	3m
Surprise Springs, California	Om	Found 1899.	97	1h
Tabarz, Thuringia	Og	Found 1854.	9	1c
Tabor, Bohemia	Ccb	July 3, 1753.	180	3e
Tadjera, Algeria	Cs	June 9, 1867.	39	4e
Takenouchi, Japan	Ck	Feb. 18, 1880.	2	4d
Tamarugal, Chile	Om	Found 1903.	6,833	2b, 2f
Tanokami, Japan	Om	Found 1885.	178	1d
Tarapaca, Chile	Om	Known since 1894.	14	2f
Tazewell, Tennessee	Off	Found 1853	336	1o
Temora, New South Wales	Ogg	Found 1880.	6	1d
Tennasilm, Esthonia	Ccay	June 28, 1872.	192	3g
Teplá, Bohemia	Om	Found 1909.	58	1c
Ternera, Chile	Dr	Found before 1891.	5	2f
Thunda, Queensland	Om	Known since 1886.	5,586	1d
Thurlow, Canada	Of	Found 1888.	189	1g
Tieschitz, Moravia	Ccy	July 15, 1878.	17	3e
Timochin, Russia	Cc	March 25, 1807.	193	3g
Tjabé, Java	Ck	Sept. 19, 1869.	134	4d
Toluca, Mexico	Om	Known before 1776.	121,048	1a, 2e
Tomatlan, Mexico	Cc	Sept. 17, 1879.	135	4n
Tombigbee River, Alabama	Da	Found 1859.	7,875	1h
Tomhannock Creek, New York	Cgb	Found about 1863.	21	4m
Tonganoxie, Kansas	Om	Found 1886.	260	1l
Toubil, Siberia	Om	Found 1891.	490	1d
Toulouse, France	Cia	April 10, 1812.	31	2o
Tourinnes-la-Grosse, Belgium	Cwy	Dec. 7, 1863.	203	2n
Trenton, Wisconsin	Om	Found 1858.	446	2c
Trenzano, Italy	Ccaz	Nov. 12, 1856.	157	3d
Treysa, Hesse	Om	April 3, 1916.	1,173	1c
Tucson, Arizona	D	Known before 1850.	460	1h
Tuzla, Rumania	Cg	Nothing known.	239	3e
Tysnes, Norway	Cgbz	May 20, 1884.	896	2m
Uberaba, Brazil	Cca	June 29, 1903.	52	4o
Uden, Holland	Cwy	June 12, 1840.	—	2n
Udipi, India	Cga	April 10, 1866.	3,320	3n
Umbala, India	Cga	1822–3.	20	3m
Union County, Georgia	Ogg	Found 1853.	43	1k
Utrecht, Holland	Ccay	June 2, 1843.	185	2n
Uwet, Southern Nigeria	H	Known before 1903.	8,901	1f
Vaalbult, South Africa	Og	Found before 1921.	157	1f

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Name.	Kind.	Date.	Weight.	Pane.
Vaca Muerta, Chile	M	Known 1861.	9,515	2l
Vago, Italy	Ccz	June 21, 1668.	7	3d
Valdinizza, Italy	Ci	July 12, 1903.	2	3d
Vavilovka, Ukraine	Amb	June 19, 1876.	10	3l
Veramin, Persia	M	May 3, 1880.	236	2h
Verkhne Dnieprovsk, Ukraine	Off	Found 1876.	24	1c
Verkhne Udinsk, Siberia	Om	Found 1854.	2,904	1d
Vernon County, Wisconsin	Ckaz	March 26, 1865.	52	4n
Victoria West, South Africa	Of	Fell 1860.	153	1f
Vigarano, Italy	Ccs	Jan. 22, 1910.	848	3d
Virba, Bulgaria	Cwa	June 1, 1873.	38	3f
Vouillé, France	Cia	May 13, 1831.	91	2n
Waconda, Kansas	Ccby	Found 1873.	363	4k
Waldron Ridge, Tennessee	Og	Known 1887.	3,330	1o
Walker County, Alabama.	H	Found 1832.	22,040	1h
Warbreccan, Queensland.	Cway	Known before 1904.	61,201	4p, 4a, 4d
Warialda, New South Wales	Da	Found 1919.	36	1e
Warrenton, Missouri	Ccy	Jan. 3, 1877.	82	4m
Weaver, Arizona	Dr	Found 1898.	155	1h
Welland, Canada	Om	Found 1888.	466	1g
Wessely, Moravia	Cga	Sept. 9, 1831.	3	3e
Weston, Connecticut	Ccb	Dec. 14, 1807.	1,061	4h
Wichita County, Texas	Og	Known before 1836.	1,397	2c
Willamette, Oregon	Om	Found 1902.	976	1n
Williamstown, Kentucky.	Om	Found 1892.	845	1l
Winburg, South Africa	Om	1881.	42	1f
Witklip, Transvaal	Cg	May 26, 1918.	2	4e
Wittekrantz, South Africa	Cwy	Dec. 9, 1880.	69	4e
Wold Cottage, England	Cwa	Dec. 13, 1795.	20,683	2p, 47a
Wooster, Ohio	Om	Known 1858.	5	1n
Yanhuitlan, Mexico	Of	Known before 1825.	305	2e
Yatoor, Madras	Cc	Jan. 23, 1852.	10,709	3p
Yonōzu, Japan	Ck	July 14, 1837.	34	4c
Youndegin, Western Australia	Og	Found 1884.	13,520	1e
Zaborzika, Ukraine	Cia	April 11, 1818.	16	3g
Zabrodje, Lithuania	Ciay	Sept. 22, 1893.	3	3k
Zacatecas, Mexico	Ob	Known before 1792.	3,836	2d
Zavid, Bosnia	Cgby	Aug. 1, 1897.	343	3f
Zebrak, Bohemia	Cc	Oct. 14, 1824.	94	3e
Zomba, British Central Africa	Cwy	Jan. 25, 1899.	2,380	4e
Zsadány, Rumania	Cc	March 31, 1875.	25	3e

Number of falls represented . . . 680
Total weight of specimens . . . 6,086,678 grams.

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LIST OF SOME SYNONYMS

Abert Iron, v. Toluca.
Adare, v. Limerick.
Agra, v. Kadonah.
Agram, v. Hraschina.
Alatyr, v. Novo-Urei.
Albacher Mühle, v. Bitburg.
Alten, v. Finmarken.
Amana, v. Homestead.
Angela, v. La Primitiva.
Arva, v. Magura.
Baird's Farm, v. Asheville.
Baldohn, v. Misshof.
Basti, v. Bustee.
Beaconsfield, v. Cranbourne.
Bécasse, v. La Bécasse.
Blake's Iron, v. Babb's Mill.
Brazos River, v. Wichita County.
Breitenbach, v. Steinbach.
Bugaldi, v. Boogaldi.
Butcher Iron, v. Coahuila.
Cabarrus County, v. Monroe.
Caille, v. La Caille.
Caney Fork, v. Smithville.
Capitan Range, v. El Capitan Range.
Carcoar, v. Cowra.
Carleton Iron, v. Tucson.
Cerro Cosina, v. Cosina.
Charca, v. La Charca.
Chartres, v. Charsonville.
Chile, v. Dehesa.
Claiborne, v. Lime Creek.
Clarac, v. Ausson.
Cléguérec, v. Kernouvé.
Cocke County, v. Cosby's Creek.
Concepcion, v. Adargas.
Crow Creek, v. Silver Crown.
Dacota, v. Ponca Creek.
Doña Inez, v. Vaca Muerta.
East Tennessee, v. Cleveland.
El Inca, v. Tamarugal.
El Nakhla el Baharia, v. Nakhla.
El Ranchito, v. Bacubirito.
Finsterhölzelrics, v. Teplá.
Fort Duncan, v. Coahuila.
Fraserburg, v. Jackalsfontein.
Gay Gulch, v. Klondike.
Gibeon, v. Bethany.
Gnarrenburg, v. Bremervörde.
Goamus Farm, v. Bethany.
Hacienda de Bocas, v. Bocas.
Hamilton Co., v. Carlton.
Howard County, v. Kokomo.
Independence County, v. Joe Wright Mountain.
Jewell Hill, v. Duel Hill.
Kansada, v. Ness County.
Kantarah, v. Sinai.
Kapeisen, v. Cape of Good Hope.
Khiragurh, v. Kheragur.
Klein Menow, v. Menow.
Krakhut, v. Benares.
Kroonstad, v. Cronstad.
La Baffe, v. Epinal.
La Bella Roca, v. Bella Roca.
Lampa, v. Cobija.
Linn County, v. Marion.
Lion River, v. Bethany.
Llano del Inca, v. Vaca Muerta.
Lockport, v. Cambria.
Logrono, v. Barea.
MacKinney, v. McKinney.
Melville Bay, v. Cape York.
Miller's Run, v. Pittsburg.
Mount Hicks, v. Mantos Blancos.
Mukerop, v. Bethany.
Nagaya, v. Nogoya.
Nagy-Diwina, v. Gross-Divina.
Nash County, v. Castalia.
Nebraska, v. Fort Pierre.
Nellore, v. Yatoor.
Ness City, v. Ness County.
Noon, v. Arispe.
Oaxaca, v. Misteca.
Ormes, v. Les Ormes.
Oshima, v. Kyushu.
Palézieux, v. Chervettaz.
Pallas Iron, v. Krasnojarsk.
Pine Bluff, v. Little Piney.
Plescowitz, v. Ploschkovitz.
Powder Mill Creek, v. Crab Orchard.
Randolf County, v. Guildford County.
Rasgata, v. Santa Rosa.
Rittersgrün, v. Steinbach.
Rockwood, v. Crab Orchard.
San Albano, v. Valdinizza.
Sanchez Estate, v. Coahuila.
Saurette, v. Apt.
Senegal River, v. Siratik.
Senhadja, v. Aumale.
Sierra de la Ternera, v. Ternera.
Signet Iron, v. Tucson.
Skookum Gulch, v. Klondike.
South-East Missouri, v. Saint Francois County.
Stewart County, v. Lumpkin.
Tabory, v. Ochansk.
Taiga, v. Toubil.
Taney County, v. Mincy.

Teilleul, v. Le Teilleul.
Tirnova, v. Aleppo.
Toyah, v. Davis Mountains.
Troost's Iron, v. Babb's Mill.
Tula, v. Netschaëvo.
Utah, v. Salt Lake City.
Varas, v. Serrania de Varas.
Wayne County, v. Wooster.
Werkhne Dnieprovsk, v. Verkhne Dnieprovsk.
Werkhne Udinsk, v. Verkhne Udinsk.
West Liberty, v. Homestead.
Whitfield County, v. Dalton.
Winnebago County, v. Forest City.
Wittmess, v. Eichstädt.
Wohler's Iron, v. Otumpa (?).
Yarra Yarra River, v. Cranbourne
Yodzé, v. Jodzie.
Yorktown, v. Tomhannock Creek.

LIST OF THE CASTS OF METEORITES IN THE BRITISH MUSEUM COLLECTION

Accalana.
Adelie Land.
*Akbarpur.
Algoma.
Annaheim.
Appley Bridge.
Arltunga.
Ashdon.
Assisi.

*Babb's Mill.
Baroti.
*Barranca Blanca.
Barratta.
Bella Roca.
Beuste.
Bingera.
Blithfield.
Boogaldi.
Braunau.
Buschhof.
*Bustee.
*Butsura.

Cabin Creek.
Cachiyuyal.
Cadell.
Caperr.
Carlton.
Carraweena.
Castalia.
Chandakapur.
*Charlotte.
Chulafinnee.
Cleveland.
Crab Orchard.
*Cronstad.
*Crumlin.

*Daniel's Kuil.
Dolgovoli.
Donga Kohrod.
Dundrum.
*Durala.

*Eli Elwah.

*Futtehpur (Bithur).

Gilgoin.
Glorieta Mountain.
Goalpara.
Gopalpur.
Gross-Divina.

Hex River Mountains.
*Homestead (small stone).
,, (large stone).

Ibbenbühren.

*Jelica.
*Jhung.

*Kaee.
Karee Kloof.
*Kheragur.
Kilbourn.
Kingston.
Kulnine.

Launton.
Leeuwfontein.
Lick Creek.
Linum.

Mazapil.
Menow.
*Mhow.
*Middlesbrough.
Mooresfort.
Mount Ayliff.
Mount Edith.
Mungindi.
Murnpeowie.

*Nedagolla.
*Nejed.
Nerft.
New Concord.
N'Kandhla.

*Obernkirchen.
*Ogi.
Otumpa.

*Parnallee.
Petersburg.
Pillistfer.
Pulsora.

*Rancho de la Pila.
Roebourne.
*Rowton.

St. Denis-Westrem.
St. Mark's.
Sarepta.
Segowlie.
Shytal.
Sindhri.
*Sitathali.
Ski.
*Steinbach (Breitenbach).
Steinbach (Rittersgrün).
*Supuhee.

*Udipi.

Vaalbult.
Verkhne Udinsk.
Virba.

*Warbreccan.
Warialda.
Welland.
*Wittekrantz.
*Wold Cottage.

Yardea.
*Yatoor.
Yenberrie.

The Trustees possess moulds of those meteorites in the preceding list of which the names are marked with an asterisk, and casts may be obtained on payment of the necessary expenses.

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LIST OF BRITISH METEORITES

Of the meteorites in the Collection the following have fallen within the British Isles :—

1. *In England.*

Name.	Date of Fall.	Weight.
Wold Cottage.	December 13, 1795.	One stone of 56 lb.
Launton.	February 15, 1830.	One stone of nearly $2\frac{1}{2}$ lb.
Aldsworth.	August 4, 1835.	One stone of about $1\frac{1}{2}$ lb.
Rowton.	April 20, 1876.	One iron of $7\frac{3}{4}$ lb.
Middlesbrough.	March 14, 1881.	One stone of $3\frac{1}{2}$ lb.
Appley Bridge.	October 13, 1914.	One stone of 33 lb.
Ashdon.	March 9, 1923.	One stone of $2\frac{3}{4}$ lb.

2. *In Scotland.*

High Possil.	April 5, 1804.	One stone of about 10 lb., most of which was broken up and lost.
Perth.	May 17, 1830.	One stone, 7 in. in diameter, of which only a fragment or two has been preserved.
Strathmore.	December 3, 1917.	Four stones of $22\frac{1}{4}$, $2\frac{1}{2}$, $2\frac{3}{8}$, and $2\frac{1}{4}$ lb. respectively.

3. *In Ireland.*

Mooresfort.	August, 1810.	One stone of $7\frac{3}{4}$ lb.
Limerick.	September 10, 1813.	A shower of several stones, the largest of 65, 24, and 17 lb. respectively.
Killeter.	April 29, 1844.	A small shower of stones, of which only a few fragments have been preserved.
Dundrum.	August 12, 1865.	One stone of nearly 5 lb.
Crumlin.	September 13, 1902.	One stone of nearly $9\frac{1}{2}$ lb.

Of these meteorites the British Museum contains the main mass of Aldsworth, Appley Bridge, Ashdon, Crumlin, Launton, Rowton, and Wold Cottage, and one of the Strathmore stones. Rowton is the only iron, and is remarkable as being one of the few meteoric irons which have been actually seen to fall.

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BRITISH MUSEUM (NATURAL HISTORY)

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No. 13.—**Mites Injurious to Domestic Animals.** With an Appendix on the Acarine Disease of Hive Bees. By S. Hirst. Pp. 107: 85 text-figures. 1922, 8vo. 3*s.* (*postage* 2½*d.*).

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No. 2.—**Furniture Mites.** Pp. 4. 1925, 8vo. Price 1*d.* (*postage* ½*d.*).

Applications to the Museum direct for any of these pamphlets should be accompanied by a remittance, including postage.

Written communications respecting them should be addressed to the Director, British Museum (Natural History), Cromwell Road, London, S.W.7.

BRITISH MUSEUM (NATURAL HISTORY)

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January, 1926.

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